SIEMENS

SINUMERIK

SINUMERIK 840D sl Basesoftware and operating software

Commissioning Manual

Valid for

Control:
SINUMERIK 840D sl/840DE sl

Software:
CNC software V4.5
SINUMERIK Operate V4.5

02/2012
6FC5397-1DP40-3BA0

Legal information

Warning notice system

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 relevant 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 product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

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.

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Industry Sector
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90026 NÜRNBERG
GERMANY

Order number: 6FC5397-1DP40-3BA0
℗ 07/2012 Technical data subject to change

Preface

SINUMERIK documentation

The SINUMERIK documentation is organized in the following categories:

- General documentation
- User documentation
- Manufacturer/service documentation

Additional information

You can find information on the following topics at www.siemens.com/motioncontrol/docu:

- Ordering documentation/overview of documentation
- Additional links to download documents
- Using documentation online (find and search in manuals/information)

Please send any questions about the technical documentation (e.g. suggestions for improvement, corrections) to the following address:

docu.motioncontrol@siemens.com

My Documentation Manager (MDM)

Under the following link you will find information to individually compile OEM-specific machine documentation based on the Siemens content:

www.siemens.com/mdm

Training

For information about the range of training courses, refer under:

- www.siemens.com/sitrain

  SITRAIN - Siemens training for products, systems and solutions in automation technology
- www.siemens.com/sinutrain

  SinuTrain - training software for SINUMERIK

FAQs

You can find Frequently Asked Questions in the Service&Support pages under Product Support. http://support.automation.siemens.com

SINUMERIK

You can find information on SINUMERIK under the following link:

www.siemens.com/sinumerik

Target group

This documentation is intended for commissioning personnel.

The plant or system is readily assembled and wired. For the following steps, e.g. configuring the individual components, the Commissioning Manual contains all necessary information or at least references.

Benefits

The intended target group can use the Commissioning Manual to test and commission the system or the plant correctly and safely.

Utilization phase: Setup and commissioning phase

Standard scope

This documentation only describes the functionality of the standard version. Additions or revisions made by the machine manufacturer are documented by the machine manufacturer.

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

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.

Technical Support

You will find telephone numbers for other countries for technical support in the Internet under http://www.siemens.com/automation/service&support

CompactFlash Cards

- Do not remove the memory card while it is being accessed. This can lead to damage of the memory card and the SINUMERIK as well as the data on the memory card.
- Insert the memory card carefully and the right way round into the memory card slot (observe indicators such as arrow or similar). This way you avoid mechanical damage to the memory card or the device.
- Only use memory cards that have been approved by Siemens for use with SINUMERIK. Even though SINUMERIK follows general industry standards for memory cards, it is possible that memory cards from some manufacturers will not function perfectly in this device or are not completely compatible with it (you can obtain information on compatibility from the memory card manufacturer or supplier).
- For further information on handling CompactFlash cards, please refer to the NCU manuals.

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SINUMERIK

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SINUMERIK Operate (IM9)

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SINUMERIK 840D sl
SINUMERIK Operate (IM9)

Commissioning Manual

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System overview

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1.1 System overview

NCU

The SINUMERIK Operate V4.x operating software is an integral component of the CNC software V4.x and can therefore run on an NCU 7x0.3. The NCU's CompactFlash card is the standard data carrier of the CNC software.

The SINUMERIK Operate operating software is started automatically when the NCU software boots and in the delivery state offers its standard functional scope, which depends on the actual NC and PLC configuration.

PCU

The SINUMERIK Operate operating software is supplied on DVD and must then be installed on the hard disk of the PCU. The operating software is automatically started when the controller boots.

PC

The SINUMERIK Operate operating software is supplied on DVD and can be installed in a freely selectable directory.

The following sections describe the expansions and adaptations that the machine manufacturer can make using the SINUMERIK Operate operating software.

References

For a description of the commissioning procedure for the SINUMERIK 840D sl controller, please refer to the following documentation:

Commissioning Manual "IBN CNC: NCK, PLC, drive Commissioning Manual".

1.2 System requirements

Overview

It is a requirement that all system components be fully mounted, installed and configured. Commissioning of the NC and PLC must have been completed. The PLC is in the "Run" condition.

- USB keyboard: Handles text input with upper- and lower-case letters.
- Storage medium, e.g. USB FlashDrive and/or network connection: Handles data exchange with an external PC/PG.

Note

When you load user data with a USB FlashDrive, the data size must not be larger than 4 GB!

SINUMERIK Operate under Windows

You require the following software if you use SINUMERIK Operate under Windows:

- PCU 50.5: WinXP PCU basic software as of V1.2
- PC: Windows XP SP3 / Windows 7 operating system

Additional programs

- TextPad text editor: Used for the external creation and editing of XML and INI files in Windows. The program is available on the Internet at: http://www.textpad.com/
- WinSCP: Enables protected data transfer between different computers (NCU - PC). The program is available on the Internet at: http://winscp.net/eng/docs/lang:de
- RCS Commander: Permits the remote maintenance for machines with the SINUMERIK Operate operating software from a standard Windows PC.
- As of V4.5, the RCS Commander provides a special conversion function to transfer alarm texts of HMI Advanced or HMI Embedded to SINUMERIK Operate.
- System Network Center (SNC): Sets up the Ethernet connection of one or more TCUs to NCU/PCU.

References

A detailed description of the structure and commissioning of the system network with controller and operator components is provided in the following description:

SINUMERIK 840D sl/840Di sl Operator Components and Networking

Principles of start-up

2

2.1 Data structure of SINUMERIK Operate

For SINUMERIK Operate, all files are saved on the CompactFlash card (NCU) or on the hard disk (PCU) or DVD (PC).

The file system is at the uppermost level:

- On the NCU in the "/System CF-Card/" directory
- On the PCU in the "F:\hmisl\" directory
- On the PC, the drive can be freely selected, e.g. "C:\Programs\siemens\sinumerik

The directory structure comprises the following directories:

- addon
- compat (only PC/PCU)
- oem
- siemens
- user

These directories have essentially an identical structure.

Note

The files in the “siemens” directory represent the original status and cannot be modified!

Files, whose contents can be supplemented or modified, are available as templates (specimen files) in the following directories:

Files	Directory
Configuration files	/siemens/sinumerik/hmi/template/cfg
Text files	/siemens/sinumerik/hmi/template/lng

Before making any changes/supplements, these files should be copied into the /cfg or /lng in /**oem**/sinumerik/hmi/, /**addon**/sinumerik/hmi/ or /**user**/sinumerik/hmi/ directories.

Structure

The section of the directory structure relevant for SINUMERIK Operate is shown below:

siemens directory			
/siemens/sinumerik			
	/hmi		
		/appl	// applications (operating areas)
		/base	// basis system components
		/cfg	// all configuration files
		/data	// version data
		/hlp	// online help files
		/hlps	// online help files, zipped and version files
		/ico	// symbol files
			/Ico640 // icons in resolution 640x480
			/ico800 // icons in resolution 800x600
			/ico1024 // icons in resolution 1024x768
			/ico1280 // icons in resolution 1280x1024
			/ico1600 // icons in resolution 1600x1240
		/lng	// text files
		/lngs	// text files zipped and versions files
		/osal	
			/ace // ACE/TAO
			/qt // Qt
		/proj	// EasyScreen configuring
		/template	// various templates
			/cfg // templates for configuration files
			/ing // templates for text files
		/tmpp	// storage, temporary data
	/sys_cache/hmi		// various log files

compat directory		
/compat		// files for integrating the OEMFrame applications
	/add_on	
	/hmi_adv	
	/mmc2	
	/oem	
	/user	

addon directory			
/addon/sinumerik			
	/hmi		
		/appl	// applications (operating areas)
		/cfg	// configuration files
		/data	// version data
		/hlp	// online help files, zipped and version files
		/ico	// symbol files
		/Ico640	// icons in resolution 640x480
		/ico800	// icons in resolution 800x600
		/ico1024	// icons in resolution 1024x768
		/ico1280	// icons in resolution 1280x1024
		/ico1600	// icons in resolution 1600x1240
		/lng	// text files
		/lngs	// text files zipped and versions files
		/proj	// EasyScreen configuring
		/template	// various templates

oem directory			
/oem/sinumerik			
	/data		// version data
		/archive	// manufacturer archive
	/hmi		
		/appl	// applications (operating areas)
		/cfg	// configuration files
		/data	// version data
		/hlp	// online help files
		/hlps	// online help files, zipped and version files
		/ico	// symbol files
		/Ico640	// icons in resolution 640x480
		/ico800	// icons in resolution 800x600
		/ico1024	// icons in resolution 1024x768
		/ico1280	// icons in resolution 1280x1024
		/ico1600	// icons in resolution 1600x1240
		/lng	// text files
		/lngs	// text files zipped and versions files
		/proj	// EasyScreen configuring
		/template	// various templates

user directory			
/user/sinumerik			
	/data		// version data
		/archive	// user-specific archive
		/prog	// user-specific programs
	/hmi		
		/cfg	// configuration files
		/data	// version data
		/hlp	// online help files
		/ico	// symbol files
			/Ico640 // icons in resolution 640x480
			/ico800 // icons in resolution 800x600
			/ico1024 // icons in resolution 1024x768
			/ico1280 // icons in resolution 1280x1024
			/ico1600 // icons in resolution 1600x1240
		/lng	// text files
		/proj	// EasyScreen configuring
		/log	// log files
		/md	// machine data views
		/proj	// EasyScreen configuring

2.2 Editing files

2.2.1 Editing the file at the controller

Use can use a copy of the sample file in order to make specific adjustments. Template files are available in the following directories:

/**siemens**/sinumerik/hmi/template/cfg and /**siemens**/sinumerik/hmi/template/lng

Save the sample file in the "user" or "oem" directory - in the appropriate folder.

Note

As soon as the file is in the user-specific directory, the entries of this file have priority over the Siemens file. If an entry is missing in a user-specific file, the corresponding entry from the Siemens file is used instead.

You need to restart the operating software for the settings made in the file to take effect.

Precondition

- If you copy files, you require access level 1 (manufacturer).
- When assigning a new file name, ensure that only files with a maximum name length of 49 characters can be managed.

Copying / pasting / opening a file

1. Select the "Start-up" operating area.

2. Press the "System data" softkey.
   The data tree is displayed.
3. For instance, on the NCU directory, "System CF card", under "siemens" open the required directory (e.g. /sinumerik/hmi/template/cfg).
4. Position the cursor on the desired file.

5. Press the "Copy" softkey.
6. For instance, on the NCU in the "System CF card" directory, under "oem" or "user" open the required directory (e.g. /sinumerik/hmi/cfg), in which the copied file should be saved.

7. Press the "Paste" softkey.
   If a file of the same name already exists, you receive a message. You can overwrite or rename the file.

8. Press the "OK" softkey.

9. You can open the selected file in the editor by pressing the "Open" softkey.

   - OR -

   Press the <INPUT> key.

   - OR -

   Double-click the highlighted file.

Rename file

1. Select the required file.
2. Press the ">>" and "Properties" softkeys.

   The "Properties of..." window opens.

   The following data is displayed:
   - Path:
   - Name:
   - Creation date and time:
   - Date of change and time:
3. To change the file name, place the cursor in the "Name" entry field and overwrite the name. Date of change and time are simultaneously updated.

4. Press the "OK" softkey to save the new name.

Cut-out/delete file

1. Select the required file.

2. Press the "Cut" softkey.

   The file is copied into the buffer and at the same time deleted from the previous directory.

   As the file is located in the buffer, you can also insert the file into another directory.

   - OR -

2. Press the ">>" and "Delete" softkeys.

   You receive an alarm and you can delete the file by pressing the "OK" softkey.

   Press the "Cancel" softkey to cancel the delete operation.

Displaying the file in the preview window

1. Select the required file.

2. Press the ">>" and "Preview window" softkeys.

   The preview window is displayed in the lower area of the window together with the file contents.

Press the "Preview window" softkey again to close the window.

2.2.2 Editing a file externally

To create or edit an XML file on an external PC with Windows, use a text editor that supports the required "UTF-8" coding, e.g. "TextPad".

This means that you can enter or directly insert all characters of the unicode system without rewriting them using the keyboard.

If files with a different coding are saved, the special characters are not correctly displayed in the editor. In SINUMERIK Operate, there is no automatic conversion into the UTF-8 coding!!

Saving the XML file in UTF-8 coding

1. Select the "Save As" dialog box.
2. Set the character set to "UTF-8".

Entering comments in an XML file

If you are entering comments to explain a program, you must keep the following in mind:

- A comment always begins with the sequence: <!--
- A comment ends with the character string: -->

Example

<!-- Work offset: -->

Note

In the comment itself, you can never use two minus signs one right after the other!

Special characters

If you use characters in the text where the syntax of XML is of significance, then these must specifically formatted:

Special characters	Notation
&	&
'	'
<	<
>	>
"	"

Comments in an ini file

If you enter a comment in an ini file, start the comment line with a semicolon.

Copy file

Using the "WinSCP" or "RCS Commander" program, copy the file from an external computer to the NCU via a network connection – or in the opposite direction from the NCU to an external PC.

For a detailed description, see the following sub-book:

References

NCU Operating System (IM7): Backing up and restoring data and WinSCP and PuTTY service tools

See also

Configuring alarm and message texts via alarm text files (Page 187)

Licensing

3

Licenses are required for the activated options. When you purchase licenses you receive a "license key" that contains all options requiring a license and which is only valid for your CompactFlash card.

Precondition

If you wish to set or reset the options for a machine, you require at least access level 3 (user).

You can only license options for a machine from this access level and higher.

General information

Serial number of the CompactFlash card	Permanently defined serial number of the CompactFlash card
Hardware type	Control data
Machine name/No.	Displays the data that is saved in machine data MD17400 $MN_OEM_GLOBAL_INFO. Only with access level 1 (manufacturer) can a display field be edited.
License key	Information about options that require a license

Procedure:

1. Select the "Start-up" operating area.

2. Press the menu forward key.

3. Press the "Licenses" softkey.

   The "Licensing" window appears and you can select the following with the vertical softkeys:

   - Determining the license requirement
     - Overview
     - All options
     - Missing licenses
   - Exporting licensing requirements
   - Entering or reading in "License key"

License database

The licenses are purchased via the Internet. There are two ways to access the license database administered by Siemens A&D:

- Web License Manager
- Automation License Manager

For a detailed description, please refer to the following documentation:

References

CNC Commissioning Manual: NCK, PLC, drive: Licensing

Deactivate options

When importing old archives from other HMI systems, it can occur that options are set which are no longer required in the actual system – however, these are subject to the license check:

Order number	Option
6FC5800-0AP04-0YB0	Machining step programming
6FC5800-0AP11-0YB0	Manual machine
6FC5800-0AP15-0YB0	ShopTurn HMI/ShopMill HMI for SINUMERIK 840Di sl incl. HMI-Advanced
6FC5800-0AP20-0YB0	3D simulation of the finished part
6FC5800-0AP21-0YB0	Simulation, milling (2D dynamic; 3D static)
6FC5800-0AP23-0YB0	Simultaneous recording, ShopMill (real-time simulation)
6FC5800-0AP24-0YB0	Simultaneous recording, ShopTurn (real-time simulation)

3.1 Determining the license requirement

Procedure

1. Press the "All options" softkey to list all the options that can be selected for this controller.

   - OR -

   Press the "Missing lic./opt." softkey.

   You receive an overview of all options that

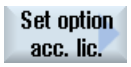
   - are not adequately licensed
   - are licensed, but which were not set

2. Activate or deactivate the required options in the "Set" column:

   - Activate checkbox or
   - Enter the number of options

   Options shown red are activated, however, not yet licensed or not licensed in adequate number.

   - OR -



   Press the "Set option according to license" softkey to activate all of the options contained in the license key.

   You obtain a confirmation prompt that you must confirm with "OK".

3. To activate new selected options, press the "Reset (po)" softkey. A safety prompt appears.

   For several options, you will have to also restart SINUMERIK Operate. Corresponding prompts will appear in the user response line.

4. Press the "OK" softkey to trigger a warm restart.

   - OR -

   Press the "Cancel" softkey to cancel the process.

Searching for options

You have the possibility of finding options using the search function.

1. The window "Licensing: All Options" or "Licensing: Non-licensed Options" is open.
2. Press the "Search" softkey and enter the required option in the search form.

   The cursor is positioned on the first entry that corresponds to the search term.
3. Press the "Continue search" softkey if the term that was found is not the option that you were looking for.

Additional search option

Press the "Go to beginning" softkey to start the search at the first option.

Press the "Go to end" softkey to start the search at the last option.

Note

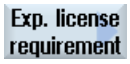
Use of non-licensed options

Before licensing options, you can also activate them temporarily without the license keys and use them for test purposes. In this case, the controller displays alarm 8080 periodically; this indicates that the option use has not yet been assigned the required license.

3.2 Exporting the license requirement

After you have determined the license requirement, you can export the data via the set-up external storage locations.

Procedure



1. Press the "Export license requirement" softkey.
   A small window opens listing the set-up storage locations.
2. Select "USB" for example, if you export the licenses on a USB FlashDrive.
   If you use the Automation License Manager (expansion module from V1.2 SP1 and later), it is not permissible that the data are in a subdirectory.

3. Press the "OK" softkey.
   The set options, the options which are not set but are licensed options, the license requirement and the license key are stored in an Alm file. This file is used by the "automation license manager" as the basis for licensing.

Transferring a license requirement

The license information is transferred electronically with the "automation license manager".

A detailed description of the license management is provided in the following documentation:

References

CNC Commissioning Manual: NCK, PLC, drive: Licensing

3.3 Reading in the license key

The newly purchased license key can be loaded to the controller as follows:

- Enter license key manually
- Read in license key electronically

Procedure

1. Press the "Licenses" softkey.

   - OR -

   Press the "Overview" softkey.

   The "Licensing" window opens.

2. If you receive the license key via the "Web License Manager", enter the license key manually in the field "You can enter a new license key here".

3. Press the <INPUT> key.

   If the license key is valid, the message "License key set" is displayed.

   - OR -

   If you receive the license key via the "Automation License Manager", press the "Read in license key" softkey.

   Open the appropriate storage location (e.g. USB) with "OK".

...

   The matching .alm file is detected automatically and the license key is read in.

   Note:

   If several matching .alm files are in the directory, they will be offered to you in a subsequent selection dialog box.

   Select the desired file.

Creating drive connections

4

Set up connections

Up to eight connections to so-called logical drives (data carriers) can be configured. These drives can be accessed in the "Program manager" and "Startup" operating areas.

The following logical drives can be set up:

- USB interface
- CompactFlash card of the NCU, only for SINUMERIK Operate in the NCU
- Network drives
- Local hard disk of the PCU, only for SINUMERIK Operate on the PCU

Software option

In order to use the CompactFlash card as data carrier, you require the "Additional 256 MB HMI user memory on CF card of the NCU" option (not for SINUMERIK Operate on PCU or PC).

Note

The USB interfaces of the NCU are not available for SINUMERIK Operate and therefore cannot be configured.

4.1 Setting up drives

The "Set Up Drives" window is available in the "Start-up" operating area for configuration.

File

The created configuration data is stored in the "logdrive.ini" file. This file is located in the /user/sinumerik/hmi/cfg directory.

General information

Entry		Meaning
Type	No drive	No drive defined.
	USB local	Access to the USB memory medium is only realized via the TCU to which it is connected. USB drives are automatically identified if the memory medium is inserted when SINUMERIK Operate powers-up.
	USB global	All of the TCUs in the plant network can access the USB memory medium. - USB global is not possible under Windows!
	NW Windows	Network drive
	Local drive	Local drive Hard disk or user memory on the CompactFlash card.
Connection	Front	USB interface that is located at the front of the operator panel.
	X203/X204	USB interface X203/X204 that is located at the rear of the operator panel.
	X204	For SIMATIC Thin Client the USB interface is X204.
Device		Names of the TCU to which the USB storage medium is connected, e.g. tcu1. The NCU must already know the TCU name.
Partition		Partition number on the USB memory medium, e.g. 1. If a USB hub is used, specify the USB port of the hub.
Path		• Start direct directory of the data carrier that is connected via the local drive. • Network path to a directory that has been released in the network. This path must always start with "//", e.g. //Server01/share3.
Access level		Assign access rights to the connections: From access level 7 (keyswitch position 0) to access level 1 (manufacturer). The particular assigned access level applies to all operating areas.
Softkey text		Two lines are available as labeling text for the softkey. %n is accepted as a line separator. If the first line is too long, then it is automatically separated into several lines. If a blank is present, then this is used as line separator.
Softkey icon	No icon	No icon is displayed on the softkey.
	sk_usb_front.png 	The icon file name displayed on the softkey.
	sk_local_drive.png 	The icon file name displayed on the softkey.

Entry		Meaning
Text file	slpmdialog	File for softkey dependent on the language. If nothing is specified in the input fields, the text appears on the softkey as was specified in the input field "Softkey text". If your own text files are saved, then the text ID, which is used to search for the text file, is specified in the "Softkey text" input field.
Text context	SlPmDialog	
User name Password		Enter the user name and the corresponding password for which the directory is enabled on the server. The password is displayed in encoded form as string of "*" characters and is stored in the "logdrive.ini" file.

Error messages

Error message	Meaning
Error occurred when closing a connection.	An existing drive was not able to be deactivated.
Error occurred when establishing a connection.	Drive connection was not able to be established.
Error occurred while establishing a connection: Incorrect entry or no authorization.	Drive connection was not able to be established.
Incorrect data	The entered data is either incorrect or inconsistent.
Function not available	The function is not supported with the current software release.
Unknown error - error code:%1	Error was not able to be assigned.

Procedure

1. Select the "Start-up" operating area.

2. Press the "HMI" and "Log. drive" softkeys.
   The "Set Up Drives" window opens.

3. Select the data for the corresponding drive or enter the necessary data.

4. Press the "Activate drive" softkey.
   The drive is activated.
   The operating system now checks the entered data and whether the connection is established. An OK message is output in the dialog line if an error is not identified.
   The drive can be accessed.
   - OR -

If the operating system identifies an error, then you receive an error message.

Press the "OK" softkey.

You then return to the "Set Up Drives" window. Check and correct your entries and re-activate the drive.

If you press the "OK" softkey, the modified data is accepted without any feedback message. You do not receive any message about a successful or unsuccessful connection.

If you press the "Cancel" softkey, then all of the data that has not been activated is rejected.

4.2 File "logdrive.ini"

Configurations of drives in the "Logical Drives" window are saved in the "logdrive.ini" file.

Structure of the "logdrive.ini" file

- You define all logical drives in section [CONNECTIONS].
- You can enter the number of the logical drives next to "ConnectionNum."

The following setting options are available for each logical drive:
(The "X" at the end stands for the number of drive connections respectively.)

`ConnectionX`	Logical path of the drive, e.g. //my computer/my path
`SK_ConnectionX`	Type of connection
`SoftkeyIndexX`	Softkey position on the horizontal softkey bar. • Index 1-8 is the first ETC level, • Index 9-16 second level, etc.
`NetDriveTypeX`	Network connection type, e.g. NFS, SMBFS
`SoftkeyPictureX`	File name of the icon displayed on the softkey
`UsernameX`	User name (for network drives)
`PasswordX`	Password belonging to UsernameX

`AccessProgrammX`
`AccessMachineX`
`AccessServicesX`
	Access authorizations for the program manager and system data areas

Drive paths

Use the following syntax to identify the drive paths:

Logical drive	Description
//NC/<nc-directory>	Current NC
/card/user/sinumerik/data	Local drive on the CompactFlash card (Linux)
//TCU/<tcu-name>/<interface>, <partition-number> <interface>: FRONT, X203, X204	Global TCU-USB drive Global TCU-USB drive with partition specification (default: 1st partition)
//ACTTCU/<interface>,<partition-number>	Local TCU-USB drive with partition specification
//<computer name/<share name><computer name>: DNS name or IP address	External network drives (WinXP)
//computer name/DNS name or IP address	Network drive

Sample structure of the logdrive.ini

Standard configuration

Syntax	Meaning
`[CONNECTIONS]`	
`ConnectionNum=1`	1. Connection
`Connection1=//ACTTCU/FRONT,1`	USB storage medium on the current TCU
`SK_Connection1=SL_PM_SK_LOCAL_TCU_USB`	Softkey labels
`SoftkeyIndex1=3`	Softkey is displayed on the horizontal bar as third softkey from the left.
`SoftkeyTextContext1=SlPmLogicalDrives`	Softkey labels
`SoftkeyTextFile1=slpmdialog`	Softkey labels
`SoftkeyPicture1=sk_usb_front.png`	The icon "sk_usb_front.png" is displayed

`AccessProgram1=7`
`AccessMachine1=7`
`AccessServices1=7`
	The softkey is visible as of access level 7 (keyswitch position 0) in the program manager

Configuring NFS drive

Syntax	Meaning
`Connection2=//ef35161c/testshare`	Connection to release "testshare" on computer ef35161c
`NetDriveType2=nfs`	with an NFS network drive
`SK_Connection2=LW_NFS`	Softkey inscription is "LW_NFS"
`SoftkeyIndex2=4`	Softkey is displayed on the horizontal bar as fourth softkey from the left

In addition, the NFS share for the client computer must be released on the NFS server.

Configuring SMB drive

Syntax	Meaning
`Connection3=//ef36557c/public`	Connection to the computer ef36557c
`NetDriveType3=smbfs`	with an SMB network drive
`Username3=test`	User name
`Password3= Passwd02`	Password (encrypted)
`SK_Connection3=LW_SMBFS`	Softkey inscription is "SMBFS"
`SoftkeyIndex3=9`	Softkey is displayed on the second horizontal bar as first softkey from the left.

In addition, you must set up an account on the Windows computer and release the directory (//ef36557c/public) for this account:

1. Properties/Release/Authorizations/Add...
2. Properties/Security/Add...

If the network drive is to be write-accessed from SINUMERIK Operate, then the specified Windows user (in the example, "test") must have write authorization for the directory released under Windows.

Note

Access to a Novell network is not allowed.

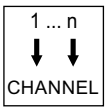
Configuring USB drive

Syntax	Meaning
`Connection4=//TCU/TCU2/X203`	USB interface X203 configured
`SK_Connection4=X203`	Softkey inscription is "X203"
`SoftkeyIndex3=10`	Softkey is displayed on the second horizontal bar as second softkey from the left

Channel menu

5

5.1 Configuring a channel menu



The channel menu is activated for display via the channel switchover key.

The channel menu is used to switchover the NC channel displayed in the SINUMERIK Operate or more precisely at the operator station. If a channel menu has been configured, when the channel switchover key is pressed, the channel menu for the channel switchover is displayed to make the appropriate operator action. If there is no channel menu, then the channel switchover key results in the HMI display advancing to the next NC channel.

Configuring

The configuration is made in the "netnames.ini" file for the operating software, as well as in the particular "config.ini" files for the individual operator stations.

To configure the data for the operator stations (entries in the "config.ini" files), instead of directly editing in the "config.ini" file, we recommend that you use the "System Network Center (SNC)" program.

The "netnames.ini" file must be generated using an editor.

Storage

The "netnames.ini" file is stored for SINUMERIK Operate in the following directory: /oem/sinumerik/hmi/cfg or /user/sinumerik/hmi/cfg

The "config.ini" file is located in the relevant directory:

- On the NCU:

  /user/common/tcu/<*TCU name*>/common/tcu/config.ini

- On the PCU:

  F:\user_base\common\tcu\<*TCU name*>\common/tcu/config.ini

For <*TCU name*>, the TCU name of the operator station should be used that was assigned at the system when a TCU powered-up for the first time. If you work with the "System Network Center (SNC)" tool, then these file paths are of no significance.

Using the channel menu

- For a system comprising several operator stations and several NCUs within the framework of operator unit management, if the NC channels of several NCKs are operated from one operator station.
- For a simple system with many NC channels, as an alternative to the standard mechanism, the channel switchover can be made using the channel switchover key.

The basic philosophy of the channel menu is to provide - in a selection menu - the operator with a view of the NC channels of all NCUs that are to be operated with the channel menu. In conjunction with this, a logical grouping/structuring is introduced using the so-called channel groups. The desired NC channel can be directly selected using the selection menu. Without a channel menu, when pressing the channel switchover key, the NC channels must be scrolled through consecutively until the desired NC channel has been selected. An operator station can only be switched over across NCUs using the channel menu.

5.2 Constraints

- Only one SINUMERIK Operate on a PCU/ PC may be permanently connected to one NCK. It is not possible to switch over to another NCK.
- SINUMERIK Operate of an NCU can only operate with its own NCK and cannot be switched over to another NCU.

5.3 General structure of the channel menu

Overview

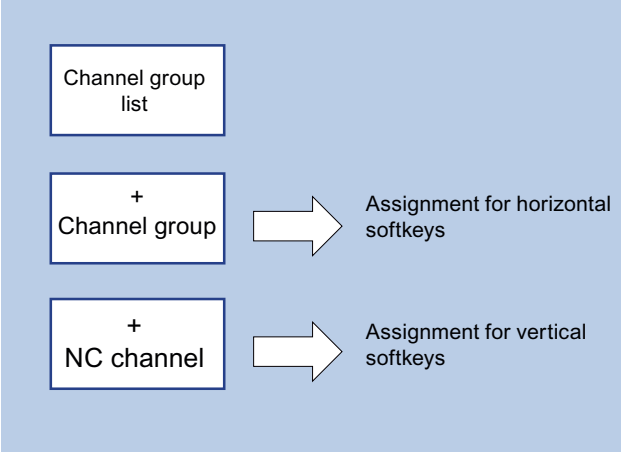
For the channel menu, a logical view is defined across all of the channels of all NCKs involved; this logical view is structured in channel groups and this in turn in specific NC channels.

A channel group list is defined for the channel menu in order to be able to switch over operation. A channel group list comprises one or several channel groups. In turn, a channel group comprises one or several NC channels.

In the channel menu, the channel groups can be selected using the horizontal softkeys.

The channels of a selected channel group can be selected with the vertical softkeys.

A certain NC channel of a specific NCU is always a switchover target that can be selected. A switchover to another channel triggered via the channel menu can implicitly mean switchover to another NCU.



Note

In a system, for example, a channel group can correspond to a machining station, the channels contained in it, machining units.

Up to 32 channel groups each with up to 8 channels can be configured in a channel menu.

Configuring the total structure

For a system, the total structure of the channel menu is configured in the "netnames.ini" file. The configuring in the "netnames.ini" file includes all switchover targets that are used at the system. This configuration must be saved or distributed in a standard form across all SINUMERIK Operate systems that provide the channel menu.

An individual channel menu for the operating station is configured for each operating station in the particular "config.ini" file.

Two-stage procedure

1. In the first stage, all channel groups that are used in the system are defined in the "netnames.ini" file, irrespective of the actual operating stations.
2. In the second stage, the version of the channel menu for the specific operating station is defined in the "config.ini" files belonging to the station.

5.4 Defining channel groups in the "netnames.ini" file

Defining channel groups

All channel groups that are used at the system are defined in the "netnames.ini" file. Independent of the specific operator stations.

A separate section [CH_GRP_x] (1 <= x <= 32) should be created for every channel group.

The entries required for a channel group are as follows:

- The text to be displayed in the channel for the channel group at the corresponding horizontal softkey.
- The list of jump destinations summarized in this channel group, i.e. NC channels. The jump destinations are defined in a consecutively numbered list with the following entries:
  - Member*y*.Target: Jump destination
  - Member*y*.Text: Softkey text to be displayed in the channel menu (1 <= y <= 8).

"netnames.ini" file

A channel group, e.g. channel group 1 is therefore specified as follows:

```
[CH_GRP_1]                      ;  Name of the channel group; the notation
                                ;  must follow this scheme. The groups are
                                ;  consecutively numbered at the last
                                ;  position.
Text = Process1                 ;  Softkey text for the channel group for
                                ;  display in the channel menu (horizontal
                                ;  softkey) switchover designation 1 of the
                                ;  channel group.
Member1.Target =                ;  Computer name (host name) or the IP
[<HMI>.]<NC>.#<channel          ;  address of the computer on which the HMI
number>                         ;  to be selected runs (NCU or PCU):
                                ;  <HMI> = <IP address or name of the HMI
                                ;  host (PC/PCU)>
                                ;  <HMI> can be omitted if the HMI runs
                                ;  locally on the NCU
                                ;  <NC> = <IP address or name of the NC>
                                ;  Alternatively, the machine name can also
                                ;  be specified from the mmc.ini.
                                ;  Using ".#Channel number", optionally the
                                ;  NC channel can be specified that should
                                ;  be taken when switching over.
                                ;
Member<No>.Text = NCU730_K1     ;  Softkey text for the display in the
                                ;  channel menu (vertical softkey). If, for
                                ;  "Target" a channel number is specified,
                                ;  then instead of a text, using the fixed
                                ;  value "$MC_CHAN_NAME", it can also be
                                ;  defined that the text to be displayed
```

```
                                ;   should be the channel name defined in
                                ;   the NCK machine data.
                                ;
Member2.Target =
Member2.Text                    ;   Same as for the vertical softkey 2
```

5.5 Configuring operating stations in the "config.ini" file

The version of the channel menu is individually defined for the operator stations in the "config.ini" files belonging to the station. The data defined in the "netnames.ini" file is used. Here, the channel groups are assigned a softkey in the channel menu.

"config.ini" file

- The data is defined in section [T2M2N].
- The references CH_GRP_xx of the softkeys refer to the channel groups which are defined in the "netnames.ini" file. This notation is binding.
- SKx in this case, designates the xth horizontal softkey in the channel menu.

Example

```
...
[T2M2N]
SK1=CH_GRP_1
SK2=CH_GRP_3
SK8=CH_GRP_15
```

"System Network Center" tool (SNC)

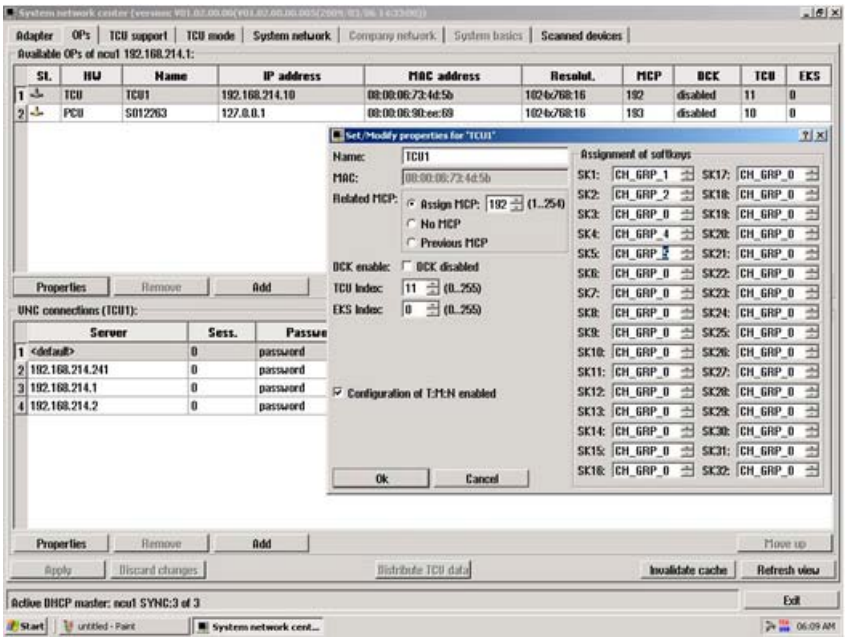
The operator stations can be configured in a transparent way using various windows with the aid of the "SNC" tool.

Calling SNC

- For the NCU, the program is also included on the CompactFlash card and is called with "sc start snc" using the service command.
- For the PCU, the program is on the hard disk and can be started from the user interface using an icon.

Configuring with SNC

1. The operator stations are listed via the "OPs" tab.
2. The "Set/Modify properties for "TCU"" is opened after selecting an OP and pressing the "Properties" button.
3. The softkey assignment is displayed after selecting the checkbox "Configuration of T:M:N enabled". The desired channel group can now be assigned to the softkey for this operator station.



Note

The PCU must not change the NCK with which it is connected during the switchover. With the switchover, it can only initiate a channel switchover on this NCU.

Note

The section [T2M2N] can also be created in the "netnames.ini" file instead of in the "config.ini" file. This setting then applies for all TCUs that are not configured via config.ini

For SINUMERIK Operate on PC, this procedure is required because it is not possible to access the "config.ini" file.

5.6 Example: Settings for 1:N

1:N configuration

For a 1:N configuration the following requirements apply:

- A PCU with SINUMERIK Operate can be connected to a maximum of four NCUs.
- SINUMERIK Operate must be switched off on all NCUs.
- The following configuration files must be adapted:
  siemens/sinumerik/hmi/template/cfg/**netnames.ini**
  siemens/sinumerik/hmi/template/cfg/**mmc.ini**

This is illustrated in the following sections using an example with 1 PCU and 2 NCUs.

Example mmc.ini

```
[Global]
NcddeMachineNames=net, NCU840D_1, NCU840D_2
NcddeDefaultMachineName=NCU840D_1

[NCU840D_1]
ADDRESS0=192.168.214.1,LINE=14,NAME=/NC,SAP=040d,PROFILE=CLT1__CP_L4_INT
ADDRESS1=192.168.214.1,LINE=14,NAME=/PLC,SAP=0202,PROFILE=CLT1__CP_L4_INT
ADDRESS2=192.168.214.1,LINE=14,NAME=/CP,SAP=0502,PROFILE=CLT1__CP_L4_INT
ADDRESS10=192.168.214.1,LINE=14,NAME=/DRIVE_00_000,SAP=0201,
SUBNET=0046-00000000:000,PROFILE=CLT1__CP_L4_INT
ADDRESS11=192.168.214.1,LINE=14,NAME=/DRIVE_03_003,SAP=0900,
PROFILE=CLT1__CP_L4_INT

[NCU840D_2]
ADDRESS0=192.168.214.2,LINE=14,NAME=/NC,SAP=040d,
PROFILE=CLT1__CP_L4_INT
ADDRESS1=192.168.214.2,LINE=14,NAME=/PLC,SAP=0202,
PROFILE=CLT1__CP_L4_INT
ADDRESS2=192.168.214.2,LINE=14,NAME=/CP,SAP=0502,
PROFILE=CLT1__CP_L4_INT
ADDRESS10=192.168.214.2,LINE=14,NAME=/DRIVE_00_000,SAP=0201,
SUBNET=0000-00000000:000,PROFILE=CLT1__CP_L4_INT
ADDRESS11=192.168.214.2,LINE=14,NAME=/DRIVE_03_003,SAP=0900,
PROFILE=CLT1__CP_L4_INT
```

Example netnames.ini

```
;*****************************************************************
;     netnames.ini      - EXAMPLE -
;
; This is an example of a netnames.ini for 1:N NCU-switching in
; a configuration of 3 NCU and a PCU50.
;*****************************************************************
[own]
owner = HMI

;**************************
; ChanMenu
;**************************
[chan HMI]
ShowChanMenu = true

;*****************************************************************
;Channel-groups
;Correlation from channel-group to horizontal softkeys
; -> see config.ini of the TCU
;The section [T2M2N] can also be created in the netnames.ini file
;instead of config.ini file. This configuration applies to all TCU,
;which are not configured by their config.ini.
;*****************************************************************
[T2M2N]
SK1 = CH_GRP_1
SK2 = CH_GRP_2

[CH_GRP_1]

Text = 1. NCU
Member1.Target = 192.168.214.241.192.168.214.1.#1
Member1.Text = NCU1%nKanal 1

Member2.Target = 192.168.214.241.192.168.214.1.#2
Member2.Text = NCU1%nKanal 2

[CH_GRP_2]
Text = 2. NCU
Member1.Target = 192.168.214.241.192.168.214.2.#1
Member1.Text = NCU2%nKanal 1

Member2.Target = 192.168.214.241.192.168.214.2.#2
Member2.Text = NCU2%nKanal 2
```

NOTICE

For switching over an MCP with the operating software, the PLC block FB9 must not be used (FB9 must not be active). If necessary, the MCP must be switched over in the PLC user program.

Solution

In the OB100 (call for FB1), set MCP1BusAdr to 255 and MCP1Stop to "true".

In the OB1, scan the "MMCBTSSready" (DB10.DBX108.3) signal. If this is set, write the MCP address from DB19.DBB123 (MCP index) to the DB7.DBB27 before removing the MCP stop bit DB7.DBX62.1. The MCP is now active.

If the "MMCBTSSready" (DB10.DBX108.3) is removed again (operating software switches to another NCU), the MCP stop bit DB7.DBX62.1 will have to be reset.

5.7 Distribution via job lists in the case of 1:N

Simplified selection of programs

The function is only available in a group of several NCUs ands must be enabled in the "systemconfiguration.ini " configuration file:

```
[miscellaneous]

distributeJoblist=true
```

The sources are located on the local drive of the PCU or the PC.

The distribution of the programs is done by selecting a job list which is located in a workpiece. The job list may contain COPY and SELECT instructions:

```
; Copy A.MPF to NCU1:

COPY A.MPF NC=NCU1

; Copy B.MPF to NCU2:

COPY B.MPF NC=NCU2

; Copy all subprograms to all NCUs:

COPY *.SPF *

; Select A.MPF on NCU1 in channel 1.

SELECT A.MPF ch=NCU1,1

; Select B.MPF on NCU2 in channel 2.

SELECT B.MPF ch=NCU2,2
```

Sequence:

1. If a distributed job list is active during the selection, all distributed programs on the NCU are deleted without confirmation. If the workpiece on the NCUs is empty, it will be deleted there.
2. The programs are copied to the corresponding workpieces of the relevant NCU.
3. Existing programs are overwritten without any message.
4. Following a change in a distributed program on the local drive, the modified programs using the Editor are copied to the corresponding NCU.

Sample structure

/user/sinumerik/data/ prog/JOBA.WPD	NCU1	NCU2
JOBA.JOB	WKS.DIR	WKS.DIR
A.MPF	WKS.DIR/JOBA.WPD	WKS.DIR/JOBA.WPD
B.MPF	WKS.DIR/JOBA.WPD/B.MPF	WKS.DIR/JOBA.WPD/B.MPF
UP1.SPF	JOBA.WPD/UP1.SPF	JOBA.WPD/UP1.SPF
UP2.SPF	WKS.DIR/JOBA.WPD/UP2.SPF	WKS.DIR/JOBA.WPD/UP2.SPF

/user/sinumerik/data/ prog/wks.dir/JOBA.WPD	NCU1	NCU2
JOBA.JOB	WKS.DIR	WKS.DIR
A.MPF	WKS.DIR/JOBA.WPD	WKS.DIR/JOBA.WPD
B.MPF	WKS.DIR/JOBA.WPD/B.MPF	WKS.DIR/JOBA.WPD/B.MPF
UP1.SPF	JOBA.WPD/UP1.SPF	JOBA.WPD/UP1.SPF
UP2.SPF	WKS.DIR/JOBA.WPD/UP2.SPF	WKS.DIR/JOBA.WPD/UP2.SPF

Supplementary conditions

Special behavior:

- Distributed programs are retained during a restart of the operating software.
- On the local drive, distributed programs can neither be deleted nor renamed nor overwritten using copy/move.
- Changes of distributed programs on the NCU are lost, if they are not manually saved.
- The program correction in the machine is not offered.
- When creating a commissioning archive, all data of the local drive is also automatically saved.

Restrictions:

- In the event of changes of distributed programs on the local drive using the Editor, it should be noted that only the channel states are monitored on the NCU currently connected. If the program is still interrupted or active on another NCU, it cannot be correctly distributed after the change.
- The display of the active block, the marking of the block search as well as the read-only handling of the program opened in the Editor are executed only for the active programs of the currently connected NCU.
- In the Editor, programs are always opened in the context of the currently connected NCU. This can lead to a faulty step recognition with distributed programs.
- In the current block display in the "Machine" operating area, you can display only the active/distributed programs of the currently connected NCU.
- The simulation of job lists via several machines is not possible.

General settings 6

6.1 Changing the language

The operating software is available as standard in 6 languages.

Selecting a language

You can define the language selection mode using the following machine data.

MD9100 $MM_CHANGE_LANGUAGE_MODE	Language selection mode
= 1	The user-interface language is specified via the "Language Selection" window (default value).

1. Select the "Start-up" operating area.

2. Press the "Change language" softkey.
   The small "Language Selection" window opens. The language most recently set is highlighted.

3. Switch the cursor to the required language.
4. Press the <INPUT> key.

- OR -

Press the "OK" softkey.

The operating software switches to the language selected.

Defining two languages

MD9100 $MM_CHANGE_LANGUAGE_MODE	Language selection mode
= 2	Selection of two languages. During operation, the "Change language" softkey can be used to toggle between these languages.

1. Select the "Start-up" operating area.

2. Press the "HMI" softkey.

3. Press the ">>" softkey.

4. Press the "Language selection" softkey.
   The "Language selection" window opens.
   All the installed languages are displayed in the fields "First language" and "Second language".
5. Select a language in each of these.
6. Press the <INPUT> key.

- OR -

Press the "OK" softkey.

During operation, you can switch between the two languages by pressing the "Change language" softkey.

6.2 Set date/time

You have the possibility of manually setting the date and time for the NCU (PLC and Linux) or PCU(PC (Windows). In so doing, you can select from various display formats.

Formats of the date display

Formats	Example
d.M.yy	3.1.09
dd.MM.yy	03.01.09
dd.MM.yyyy	03.01.2009
d/M/yy	3/01/09
dd/MM/yy	03/01/09
dd/MM/yyyy	03/01/2009
M/d/yy	1/3/09
MM/dd/yy	01/03/09
MM/dd/yyyy	01/03/2009
yyyy/MM/dd	2009/01/03

The following applies:

Date	Description of the entry
d	Single or double digit day of the month (1 - 31).
dd	Double digit day of the month, with leading zero (01 - 31).
M	Single or double digit month of the year (1 - 12).
MM	Double digit month of the year, with leading zero (01 - 12).
yy	Double digit year (00 - 99).
yyyy	Four-digit year (e.g. 2009).

Time display formats

Formats	Example	Hour system
H:m:s AP	1:2:4 PM	24 hour system, with display of "AM" / "PM"
h:m:s ap	1:2:8 pm	12 hour system, with display of "am" / "pm"
HH:mm:ss AP	13:02:08 PM	24 hour system, with display of "AM" / "PM"
hh:mm:ss ap	01:02:09 pm	12 hour system, with display of "am" / "pm"
H:mm:ss AP	1:02:09 PM	24 hour system, with display of "AM" / "PM"
h:mm:ss ap	1:02:09 pm	12 hour system, with display of "am" / "pm"
h:mm:ss	13:02:09	24 hour system
hh:mm:ss	13:12:04	24 hour system

The following applies:

Time symbol:	Description of the entry	
h	Single or double digit hour (0 - 23 or 1 - 12 for am/pm).	
hh	Double digit hour, with leading zero (00 - 23 or 01 - 12 for am/pm).	
H	Single or double digit hour (0 - 23 for AM/PM).	
HH	Double digit hour, with leading zero (00 - 23 for AM/PM).	
m	Single or double digit minute (0 - 59).	
mm	Double digit minute, with leading zero (00 - 59).	
s	Single or double digit second (0 - 59).	
ss	Double digit second, with leading zero (00 - 59).	
AP	Display of the time of day:	AM or am = before midday or PM or pm = after midday

Procedure

1. Select the "Start-up" operating area.

2. Press the "HMI" softkey.

3. Press the "Date/Time" softkey.
   The "Set Date and Time" window opens.

4. Select the required formats for the date and time with the <SELECT> key in the "Format" field.

5. For SINUMERIK Operate in the NCU: In the entry fields after "new" enter the actual date and time.
   For SINUMERIK Operate on PCU/PC: In the entry fields after "new NCU + PCU" enter the actual date and time.

6. Confirm the entry with the "OK" softkey.
   The new date and time details are accepted and output in the fields "actual NCU" and "actual PCU".

6.3 Configuring Caps Lock

The "CAPSLOCK on" function ensures that text entered via an external keyboard is always entered in upper case and not in lower case.

The key behavior is set using the following display machine data.

Setting

MD9009 $MM_KEYBOARD_STATE	
= 0	CAPSLOCK off (default value)
= 2	CAPSLOCK on

If the machine data is changed, the system must be rebooted.

6.4 Defining the access rights for the "HMI restart" softkey

Displaying the machine data

Using the following display machine data, set the access rights from which access level the "HMI restart" softkey is displayed.

For SINUMERIK Operate on PC or PCU, the "EXIT" softkey is displayed.

MD9110_$MM_ACESS_HMI_EXIT	Access level of the "EXIT" softkey
= 1	Access level 1 (manufacturer), default value

6.5 Darken screen

Defining the time until the screen is darkened

The duration (in minutes), after which the screen is automatically darkened if no key is pressed on the keyboard, can be specified using the display machine data MD9006 $MM_DISPLAY_SWITCH_OFF_INTERVAL.

Interface signal

The screen is darkened by setting an interface signal.

DB 19 byte	Signals to the operator panel front (PLC -> HMI)	
DBB0	Bit 1	Bit 0
	Darken screen	Brighten screen

The following applies when actively darkening the screen using the interface signal:

- It is then no longer possible to light up the screen again from the keyboard.
- The first keystroke on the operator panel already triggers an operator action.

Note

In order to prevent accidental operator actions via the interface signal when the screen is darkened, we recommend disabling the keyboard at the same time.

6.6 Switching EXTCALL off

It is possible to access files located on network drives from a part program using the EXTCALL command.

EXTCALL must be switched off, when in certain configurations two SINUMERIK Operate are connected to one NCU.

Setting

Processing EXTCALL calls is switched-on or switched-off using the following display machine data.

MD9106 $MM_SERVE_EXTCALL_PROGRAMS	
= 0	Switch off call processing
= 1	Switch on call editing (default value)

6.7 Access levels

6.7.1 Definition of access levels

Access to programs, data and functions is protected in a user-oriented hierarchical system of seven access levels. These are divided into

- Three password levels for manufacturer, service and users
- Four keyswitch positions for users

There are access levels 1 to 7 (see table below); where

- 1 is the highest and
- 7 is the lowest level.

Table 6- 1 Access level concept

Access level	Protected by	Area
1	Password: SUNRISE (default value)	Manufacturer
2	Password: EVENING (default value)	Service
3	Password: CUSTOMER (default value)	User
4	Keyswitch 3	Programmer, machine setter
5	Keyswitch 2	Qualified operator
6	Keyswitch 1	Trained operator
7	Keyswitch 0	Semi-skilled operator

6.7.2 Modifying the access levels password

Overview

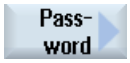
You can activate the access levels protected with passwords from the user interface.

The following options are available for editing the passwords:

- Set new password
- Change password
- Delete password

Setting the password

1. Select the "Start-up" operating area.



2. Press the "Password" softkey.

3. Press the "Set password" softkey.
   The "Set Password" window opens.

4. Enter one of the possible default passwords and press the "OK" softkey to confirm the entry.
   A permissible password is set and the valid access level is displayed. Invalid passwords will be rejected.

Change password

You must change the standard passwords to obtain a secure access protection.

1. Press the "Change password" softkey.
   The "Change Password" window opens.
2. Select the area (e.g. user) for which you want to assign a new password.
3. Enter the new password in the input fields "New password" and "Repeat password."
4. Press the "OK" softkey to confirm your entry.
   A new, valid password is only accepted if the two terms entered are identical.

Delete password

Press the "Delete password" softkey. The access authorization is reset.

NOTICE
Access authorization is not automatically deleted at POWER ON.
When a general NCK reset is performed, the passwords are reset to the default passwords.

6.7.3 Access levels for programs

Objective

Access levels can be allocated to protect information; they can also be used to prevent unauthorized operation or deliberate damage to the control system or machine.

With access authorization levels to files and directories, it can be defined as to which users are authorized to execute which operations on a directory or a file in a file system. Operations in this sense include:

- Reading the contents of a file (READ), copying the file or placing the file in an archive.
- Changing the contents of a file (WRITE) or deleting the file.
- Executing a file (EXECUTE).
- Listing a file in a directory and displaying (SHOW).
- Creating a file in a directory.

- Displaying or reading the contents of a directory.
- Creating or deleting a directory.

Description of functions

The **individual allocation of access rights** acts, in the passive NCK file system, on the following directories:

- Part programs
- Subprograms
- Manufacturer cycle directory
- User cycle directory
- Workpieces directory
- Workpiece directories

Further, the function acts on the files of the main program type (*.mpf) and subprograms or cycle (*.spf).

In addition, the technique can be expanded to include the following directories on the local drive:

- Part programs
- Subprograms
- Workpieces directory
- Workpiece directories

Note

Working via remote access

When working via remote access (e.g. WinSCP or RCS Commander) the same access rights apply for editing or saving files and directories as directly at the controller.

Access rights via machine data

The following machine data is still available to **globally allocate access rights**:
MD51050 $MNS_ACCESS_WRITE_PROGRAM

Default setting = 4 (access level: User)

Note

Effect of access rights

The more restrictive setting is always effective both when individual access rights have been allocated and when settings have been made via MD51050 $MNS_ACCESS_WRITE_PROGRAM.

Settings in the file slfsfileattributes.ini

The slfsfileattributes.ini file is available as template in the following directory:

../siemens/sinumerik/hmi/template/cfg

The values from 0 ... 7 correspond to the access levels that, for example, also apply to the password. The 4-digit numbers designate the sequence according to the following rights:

Significance from the left → right: R W X S		
R	READ	Reading files and directories
W	WRITE	Changing, deleting or creating files and directories
X	EXECUTE	Executes program: For files, for directories, always 7
S	SHOW	Outputs a list of files and directories

Copy the slfsfileattributes.ini file into one of the following directories:

../**oem**/sinumerik/hmi/cfg or ../**user**/sinumerik/hmi/cfg

The operating software must be restarted in order that the changes become effective.

Example

The paths are composed of the data type identifiers. In the following example, "\wks.dir*.wpd*.mpf" comprises the data type for workpiece directories "wks.dir" the workpieces "*.wpd" and the part programs "*.mpf".

For all workpieces, 7777 is defined as default setting for new part programs.

All entries are in the section [ACCESSMASKS] and have the following form:

```
[ACCESSMASKS]

\wks.dir\*.wpd\*.mpf = 7777
\mpf.dir\*.mpf = 6577
\cus.dir\*.spf = 6577
```

See also

Auto-Hotspot

6.7.4 Access rights for files

Changing access rights

Access rights for execution, writing, listing and reading are displayed in the "Properties" window.

- Execute: is used for the selection for execution.
- Write: controls the changing and deletion of a file or a directory.

For NC files, you have the option to set the access rights from keyswitch 0 to the current access level, to be set separately for each file.

If an access level is higher than the current access level, it cannot be changed.

For external files (e.g. on a local drive), the access rights are displayed to you only if settings have been executed for these files by the machine manufacturer. They cannot be changed via the "Properties" window.

Note

Settings for the access rights to directories and files

Via the configuration file and MD51050, access rights of the directories and file types of the NC memory and user memory (local drive) can be changed and pre-assigned.

Configuration file slfsfileattributes.ini

The access rights defined in the configuration file slfsfileattributes.ini and in MD51050 become valid in the NC when creating new files and can then be changed individually in the Program Manager with the "Properties" function. The access rights are an individual attribute of each file in the NC.

The access rights defined in the configuration file slfsfileattributes.ini and MD51050 become valid for external data on the CompactFlash Card of the NCU, or on the hard disk of the PCU/PC immediately for all the specified directories and file types, and cannot be changed through operation. The access rights can only be set globally for external data.

6.7.5 Access levels for softkeys

Use

The display and operation of softkeys can be suppressed by both the OEM as well as the user. This allows the operating software to be specifically adapted to the required functional scope and therefore be configured as transparently as possible.

This means that the functional scope of the system is restricted, to prevent access to functions in the operating software, or to restrict the possibility of operator errors.

Access hierarchy

A new access level can only be allocated for those softkeys that are also visible and can be used in the actual access level.

Example: If a softkey is only accessible with the "Manufacturer" access level, then the access level cannot be changed by an operator with access level "Key-operated switch setting 3".

Restrictions

In order to guarantee that the system remains stable and operable, certain softkeys are excluded from the access level change, e.g. the "Customize softkeys" softkey itself, in order that the undo path is not cut-off or the softkey "<< Back" to the vertical softkey bar.

The following softkeys cannot be hidden or the access level changed:

- All "OK" softkeys
- All "Cancel" softkeys
- All "Accept" softkeys
- All "**<<**" Back and "**>>**" Continue softkeys

The access level for softkeys in the cycle dialog boxes can also be changed; this does not apply to softkeys in Easy Screen dialog boxes.

Note

Software upgrade

As all changes of the access levels for softkeys are described using the softkey ID, they still remain valid after a software upgrade, which may have resulted in softkeys being shifted.

Softkeys, where access is already protected by machine data - for example MD51045 $MNS_ACCESS_TEACH_IN - are only protected by the allocated access level after a new one has been allocated. The machine data is no longer evaluated.

All of the softkeys hidden using this mechanism can be temporarily displayed again using the access rights specified by the system. This is done using the "Show all softkeys" softkey. The softkey is deactivated as long as no softkeys have been allocated new access levels: This setting remains effective until the system is rebooted.

6.7.6 This is how you define new access levels for softkeys

General sequence

In order to assign a new access level to a softkey, proceed as follows:

- Activate the adaptation mode.
- Change the access level of a softkey.
- Accept the changes and confirm.

Preconditions

Access to the "Customize softkeys" is protected using a general MD51073 $MNS_ACCESS_SET_SOFTKEY_ACCESS. This machine data is pre-assigned access level 3, i.e. the function is available from "Service" password and higher. In order that an operator with "User" access level can use this function, this machine data should be set to a value > 3.

An external mouse is required in order to make changes.

Changing the access level of a softkey

Procedure:

1. In the "Start-up" operating area, select the "HMI" menu.
2. On the expansion bar "**>>**" select the "Customize softkeys" softkey.

   You can obtain precise information about the procedure in the following dialog.
3. Confirm with "OK", in order to activate the "Customize the softkey access levels active" mode. A table is displayed.
4. Select an operating area.
5. Place the mouse cursor on a softkey and using the right-hand mouse key call the context menu "Define access level", in order to define a new access level for this softkey.
   - The displayed access level is the default setting.
   - A softkey is practically made invisible with "Always hide".
   - You can reset the additionally allocated access level using "Original setting". This selection is only listed after an individual access level was set.
6. In order to accept changes, return to the "Start-up" operating area and there, press the "Close customizing" softkey. This means that you exit the "Customize the softkey access levels active" mode.

   If you acknowledge the following query with "OK", then the changes are accepted and become effective once the system has rebooted.
7. If the changes to a softkey are not to be applied, select the line and press the "Original setting" softkey. This means that in the "New access level" column, the "Original setting" identifier is entered, which functions in the same way as deletion. This entry is no longer available following a system restart. "

Example

The following access levels were changed:

Softkey	New access level
SISuMainScreenMenuHu::0::3	Manufacturer
SIMaJogMillMenuHU::jogHuMore::6	User
SISuPaUserDataMenu::::4	Service

Once selected, the identifier and position of the softkey are transferred to the "Softkey" column.

Result

When the changes have been accepted, a configuration file with the "slsoftkeyaccess.xml" name is created and is saved in the file system under the following path: ../**user**/sinumerik/hmi/cfg. Files can also be saved in the **/oem** path, which are evaluated when the system boots. The following priority applies: oem < user.

NOTICE
Editing the file "slsoftkeyaccess.xml" In order to avoid errors in the xml syntax and for the softkey identifier the "slsoftkeyaccess.xml" file may only be edited via the operating software as described above, and not directly in the file system under "System data". It is possible that the complete file or individual entries for softkeys can no longer be interpreted.

6.8 Manual machine

Software option

To work with the "manual machine", you require the "ShopMill/ShopTurn" option.

"Manual machine" allows you to work with large cycles in manual mode without having to write programs especially for this purpose.

References

For a detailed description of the available functions and how to use "Manual machine", please refer to the:

Turning/Milling Operating Manual

Activation

MD52212 $MCS_FUNCTION_MASK_TECH		Cross-technology function mask
Bit 8	Manual machine (ShopMill/ShopTurn)	

Enables

MD52214 $MCS_FUNCTION_MASK_MILL		Milling function screen
Bit 5	Enable spindle control of the tool spindle via user interface	
Bit 6	Enable spindle control of the lathe spindle via user interface	

MD52218 $MCS_FUNCTION_MASK_TURN		Turning function screen
Bit 3	Enable spindle control of the main spindle via user interface	
Bit 4	Enable spindle control of the counter-spindle control via user interface	
Bit 5	Enable spindle control of the tool spindle via user interface	

Machine and setting data

7

7.1 Machine and setting data

Overview

Prefix	Number ranges	Machine/setting data	Storage in range (softkey)
$MM	9000 - 9999	Display machine data	Display MD
$MNS	51000 - 51299	General configuration machine data	General MD
	51300 - 51999	General cycle machine data	
$MCS	52000 - 52299	Channel-specific configuration machine data	Channel MD
	52300 - 52999	Channel-specific cycle machine data	
$MAS	53000 - 53299	Axis-specific configuration machine data	Axis MD
	53300 - 53999	Axis-specific cycle machine data	
$SNS	54000 - 54299	General configuration setting data	General SD
	54300 - 54999	General cycle setting data	
$SCS	55000 - 55299	Channel-specific configuration setting data	Channel SD
	55300 - 55999	Channel-specific cycle setting data	
$SAS	56000 - 56299	Axis-specific configuration setting data	Axis SD
	56300 - 56999	Axis-specific cycle setting data	

References

You can find a detailed description of the machine and setting data in the following documentation:

- List Manual (book 1)
- Detailed machine data

7.2 Displaying/editing machine data

You can access the following machine data in the "Start-up" operating area.

- General machine data ($MN) and general configuration machine data ($MNS)
- Channel-specific machine data ($MC) and channel-specific configuration machine data ($MCS)
- Axis-specific machine data ($MA) and axis-specific configuration machine data ($MAS)
- Drive-specific machine data ($M_)
- Machine data control unit: Drive parameters
- Machine data feed-in: Drive parameters
- I/O component parameters: Drive parameters
- Communication parameters (CULINK, DMC): Drive parameters

Note

The display of the machine data / drive parameters depends on the configuration of your controller.

Access authorization to the machine data operating area can be controlled by keyswitch position or password.

Read-access to machine data is possible as of access level 4 (keyswitch 3).

Machine data can be changed with access level 1 (manufacturer).

⚠ DANGER

Changes in the machine data have a considerable influence on the machine. Incorrect configuration of the parameters can endanger human life and cause damage to the machine.

Information about machine data

The following information is displayed from left to right:

- Machine data number, with array index if applicable
- Machine data name
- Value of the machine data
- Unit of the machine data
- Effective

Note

If the machine data does not use units, the corresponding column is empty. If the data is not available, the hash symbol "#" is displayed instead of the value. If the value ends in an "H", it is a hexadecimal value.

The physical units of machine data are displayed on the right-hand side of the input field.

For each machine data item, an activation type can be read in the column on the right.

so	Immediately active: No action required
cf	Configuration: "Set MD to active (cf)" softkey
re	Reset: <Reset> key on the machine control panel
po	POWER ON: "Reset(po)" softkey

Procedure

1. Select the "Start-up" operating area.

2. Press the "Mach. data" softkey. Additional softkeys for the individual machine data areas are displayed.

3. Press the "General MD", "Channel MD", or "Axis MD" softkey.
   The window opens and the selected machine data is displayed.

4. Place the cursor on a machine data item.
5. Position the cursor on the entry to be modified and enter the required value.
6. Depending on the activation type, there are two ways of activating the settings:

   Press the "Activate MD (cf)" softkey. The value is applied.

   - OR -

   Press the "Reset (po)" softkey.
   A safety prompt appears.

7. Press the "OK" softkey to trigger a warm restart.

   - OR -

   Press the "Cancel" softkey if you do not want to apply the settings.

Axis selection

If several components are available for the area selected (e.g. "Axis MD"), you can choose from the following options:

1. Press the "Axis +" or "Axis -" softkey.
   The values of the next (+) and the previous (-) axes are displayed.

- OR -

Press the "Direct selection..." softkey.
The "Axis Direct Selection" window opens.

2. Select the required axis directly from those available in the drop-down list box.

3. Press the "OK" softkey to save the setting.

- OR -

Press the "Cancel" softkey to reject the settings.

7.3 Displaying/editing display machine data

You can access the display machine data via the user interface in the "Start-up" operating area.

Procedure

1. Select the "Start-up" operating area.

2. Press the "Mach. data" softkey.

3. Press the menu forward key.
   Further softkeys are displayed.

4. Press the "Display MD" softkey.
   The display machine data appears.
5. Position the cursor on the entry to be modified and enter the required value.

6. Press the "Reset (po)" softkey.
   A safety prompt appears.

7. Press the "OK" softkey to trigger a warm restart.

   - OR -

   Press the "Cancel" softkey if you do not want to apply the settings.

7.4 Displaying/editing setting data

You can access the following setting data via the user interface in the "Startup" operating area.

- General setting data
- Channel-specific setting data
- Axis-specific setting data

Procedure

1. Select the "Start-up" operating area.

2. Press the "Mach. data" softkey.

3. Press the menu forward key.
   The softkeys "General SD", "Channel SD", and "Axis SD" are displayed.

4. Press the relevant softkey to display a particular setting data area.
   The window opens and the selected setting data is displayed.

5. Place the cursor on the desired setting data and position the cursor on the entry to be changed. Enter the desired value.
6. Depending on the activation type, there are two ways of activating the settings:

Press the "Activate MD (cf)" softkey.

- OR -

Press the "Reset (po)" softkey.

A safety prompt appears.

7. 

Press the "OK" softkey to trigger a warm restart.

- OR -

Press the "Cancel" softkey if you do not want to apply the settings.

Axis/channel selection

If several components are available for the area selected (e.g. "Axis SD" or "Channel SD"), you can choose from the following options:

1. Press the "Axis +" or "Axis -" or "Channel +" or "Channel -" softkey.

   The values of the next (+) and the previous axis/channel (-) are displayed.

- OR -

Press the "Direct selection..." softkey.

The "Direct Selection" window opens.

2. Select the required axis directly from those available in the drop-down list box.
3. 

Press the "OK" softkey to save the setting.

- OR -

Press the "Cancel" softkey to reject the setting.

7.5 Displaying/editing drive parameters

The "Control Unit MD", "Infeed MD" and "Drive MD" softkeys as well as the "I/O comp. MD" and "Comm MD" on the menu forward key are available to display and edit drive parameters.

A separate list display is provided for each of these areas in which you can view and edit drive data.

Precondition

Settings for drive parameters are protected with access level 2 (service).
The lists of the drive parameters are visible with access level 4 (keyswitch 3).

Please refer to the following documentation for information on commissioning the drive:

References

CNC Commissioning Manual: NCK, PLC, drives

Procedure

1. Select the "Start-up" operating area.

2. Press the "Mach. data" softkey.
   The softkeys "Control unit MD", "Supply MD", and "Drive MD" are displayed.
3. Press the softkey of an area to show its parameters.
4. Place the cursor on the desired parameter.
5. Position the cursor on the entry to be modified and enter the required value.

6. In order to activate the settings, you have the option of saving or carrying out a reset.
   Press the "Save/reset" softkey.

7. Press the "Save" softkey.
   You are prompted "What do you wish to save?"
   You can make the following selection per softkey:
   - Actual drive object
   - Drive unit
   - Drive system

   - OR -

   Press the "Reset (po)" softkey.
   You are prompted as to whether you wish to initiate a warm restart for the NCK and the complete drive system.

Confirm the prompt with the "Yes" softkey.

Reject the warm restart using the "No" softkey.

Extended reset

If you wish to carry out a warm restart only for specific objects or specific areas, then additional softkeys are available for this purpose.

Press the "Extended reset" softkey.

You are prompted to enter for which objects you wish to initiate a warm restart.

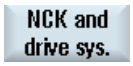
You can make a selection using the following softkeys:

Only the NCK is restarted.

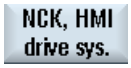
Only the currently selected drive unit (CU) is restarted.

The NCK and the selected drive unit are restarted.

All of the control units in the system are restarted.



All of the control units and the NCK in the system are restarted. This softkey corresponds to the "Reset (po)" softkey if you confirm the prompt with "Yes".



All of the control units and the NCK in the system as well as the operator software are restarted.

Hiding the expanded softkey bar

The "Extended reset" softkey is defined in the "slsuconfig.ini" file. If the softkey is not to be displayed, proceed as follows:

1. Copy the "slsuconfig.ini" file from the /**siemens**/sinumerik/hmi/template/cfg/ directory.
2. Insert the file into the following directory:
   /**user**/sinumerik/hmi/cfg/
3. Open the file and in the section
   [Softkeys]
   AdvancedReset = **0**

7.6 Machine data display filter

Through the use of the machine data display filter, it is possible to reduce the number of displayed machine data relating to a certain area, e.g. general machine data, for special purposes.

Machine data areas

Display filters are available for the following machine data areas:

- General machine data
- Channel-specific machine data
- Axis-specific machine data
- Drive machine data
- Display machine data

Filter options

It is possible to limit the machine data display using the following filtering methods:

- Filter according to indices
- Filter according to display groups
- Display expert parameters

Indices from ... to

The index filter refers to the machine data arrays. On the display, this machine data can be identified by the array index attached to the machine data string.

Example: 10000[index]AXCONF_MACHAX_NAME_TAB

If the index filter is activated, machine data arrays are only displayed in the specified index area.

Display groups

A display group contains machine data within a machine data area that belongs to the same topic.

Note

To find out which display group a machine data item belongs to, refer to the "Display filter" parameter associated with the description of the machine data element in question.

References: 840D sl Parameter Manual

Select/deselect display groups to increase or decrease the number of machine data items displayed for the current machine data area.

Display expert parameters

If the "Display expert parameters" filter is disabled, only the machine data in a machine data area that is required for the basic functionality of the NC is displayed.

Procedure

1. Select the "Start-up" operating area.

2. Press the "Mach. data" softkey.

3. Press the softkey of a particular data area, e.g. "General MD".
   The list of general machine data is displayed.

4. Press the "Display options" softkey.
   The "Display Options: ..." window ..." for the selected machine data opens.
5. Select the required filter options (according to display groups, indices or expert parameters) by activating the checkboxes.

6. Press the "Select all" softkey to activate all display groups.

   - OR -

   Press the "Deselect all" softkey.
   All checkmarks are removed and you can select individual display groups.

7.7 Editing machine data and drive parameters

7.7.1 Editing hexadecimal values

You can use a bit editor to enter the required values for machine data in hexadecimal format.

Procedure

1. Select the "Start-up" operating area.

2. Press the "Mach. data" softkey and select the required machine data area (e.g. general machine data).
3. Position the cursor on the entry to be edited.

4. Press the <SELECT> or <INSERT> key.
   The "Bit Editor" window opens.
   All bits of the machine data item that have a description text are displayed.
5. If you activate the "Display all bits" checkbox, all bits regardless of their data type (8, 16 or 32 bits) are displayed. Activate the relevant bit.

6. Press the "OK" softkey. The setting is checked and an error message may be output.
   The window closes and you return to the machine data overview.
   The new value is displayed in hexadecimal format.

7.7.2 Editing BICO values

You can use the BICO editor to enter BICO values for drive parameters.

Note

BICO values can also be entered by copying and inserting or also directly entered the field.

Procedure

1. Select the "Start-up" operating area.

2. Press the "Mach. data" softkey.

3. Press the "Control unit MD" softkey and select a BICO parameter, e.g. "p738".
4. Position the cursor on the entry to be changed, e.g. BICO 63.2091.0

5. Press the <SELECT> or <INSERT> key.
   The "BICO Editor" window opens.
6. Complete the "Drive object number", "Parameter number", "Bit/Index" and "Parameter value (hex)" fields.

Note

The BICO editor also opens if you enter a value other than 0 or 1 for the value to be changed.

7.7.3 Editing enum values

For drive parameters, you have the option of editing enum elements (e.g. r2, p3, p4, p97 etc.) using a selection list.

Procedure

1. Select the "Start-up" operating area.

2. Press the "Mach. data" softkey.

3. Select the desired drive parameter area, e.g. "Control unit MD".

4. Select the desired parameter, e.g. "p3" and position the cursor at the entry to be changed, e.g. "[1] Display, Si...".
5. Press the <SELECT> or <INSERT> key.

   A window containing a list of all defined enum values and their descriptions opens.

6. You can select a value from the list.

   - OR

   You can also directly enter the value as decimal number into the brackets [ ].

7.8 Searching for data

You can search for specific machine, setting and display machine data.

Search strategies

- When a digit or a digit with an index is entered, an exact search for this parameter is performed.

  Example: If "9" is entered > p9 will be found (but not p99)

- When text is entered, a full-text search is performed: i.e. the term is sought in the relevant table and in the status bar.

Procedure

1. Select the "Start-up" operating area.

2. Press the "Mach. data" softkey.
3. Select an area by pressing the relevant softkey.

4. Press the "Search..." softkey and enter the required text or digit in the search screen.

   The cursor is positioned on the first entry that corresponds to the search term.

5. Press the "Continue search" softkey if this machine, setting or display machine data item is not the one you are looking for.

Additional search option

Press the "Go to start" softkey to start the search at the first data.

Press the "Go to end" softkey to start the search at the last data.

7.9 Managing data

Overview

The "Manage data" function is used to simplify the commissioning and permits the transfer, backup, loading and comparing of machine, setting, compensation and drive data at the file level. The files are saved in the .tea ASCII format.

The "Manage data" softkey is visible as of access level "Service" (= 2).

The following option fields are available in the "Transfer Machine Data" window:

- Transfer data within the controller

  Only those controller objects are listed that are currently available in the controller.

- Save data to a file

  Additional files with the extensions .acx and .log are created for the SINAMICS parameters:

  – Files with the extension .acx contain the parameter descriptions for the selected drive object.

  – The log file may also contain the warnings and errors that occurred during the conversion from .acx to .tea.

- Load data from a file

NOTICE
An NCK and drive reset is only triggered automatically for drive objects after loading. A reset must be triggered manually for all other controller objects.

- Compare data

  Several files (.tea) and/or controller objects (axis, channel, servo, infeed, etc.) can be compared at the same time. An online comparison of constantly changing data is not possible because the values are saved temporarily at the time of the comparison.

  Up to eight elements can be taken into the list of the data to be compared.

Procedure

1. Select the "Start-up" operating area.

2. Press the "Mach. data" softkey.

   The "Manage data" softkey is available in each machine data area, except in "User views".

   - OR -

   Press the "System data" softkey and select the HMI data/Data backups/IB data directory.

3. Press the "Manage data" softkey.

   The "Transfer Machine Data" window opens.

4. Activate the required option filed and press "OK".

Transfer data within the controller

5. Position the cursor on a controller object and confirm with "OK".

6. In the window that opens, select the target controller object and confirm with "OK".

Save data to a file

5. Position the cursor on a controller object and confirm with "OK".

6. The "Save Under: Select Archive" window opens and the appropriate storage location is preselected.

   If required, press the "New directory" softkey to generate a new subdirectory. Enter the required name in the "New Directory" window and confirm with "OK".

7. In the "New File" window, enter the required name for the file to be saved and confirm with "OK".

   The stored files can be found in the data tree of the "System data" in the HMI data/Data backups/IB data directory.

Load data from a file

5. The "Load Trace: Select File" window opens.

   Position the cursor on a .tea file that is located either in the IB data directory or on a USB-FlashDrive and confirm with "OK".

   Please note: If the source and target drive object numbers differ when loading drive data, you must adapt individual parameters. To do this, press the "Adapt" softkey and edit the parameter values in the window that appears.

Compare data

5. In the "Compare Data - Controller" window, select an element to be compared from the tree structure of the control objects.

   - OR -

   Press the "File" softkey to select a .tea file to be compared from the tree structure of the files.

6. Press the "Add to list" softkey.

   The list of the data to be compared is displayed in the lower part of the window and the selected element is added.

7. Press the "Delete from list" softkey to remove individual elements from the comparison list.

   - OR -

   Deactivate the checkbox of the selected element in the list of the data to be compared.

8. When at least two elements are listed, the "Compare" softkey is enabled. Press this softkey to perform the comparison.

7.10 User views

Use

In the "User Views" window you can create and adapt all machine data relevant to a particular functionality. Machine data is individually collated to simplify the user's task.

You can include additional comments when creating and/or editing user views.

Note

Importing user views (compatibility)

If you have already created user views in HMI-Advanced, copy the *.klb files to /**user**/sinumerik/hmi/template/user_views to use them in SINUMERIK Operate.

Display in the the "Parameter" operating area

Proceed as follows to show user views also in the "Parameters" operating area:

1. Select the "Start-up" operating area.
2. Press the "Machine data" softkey.
3. Press the "User views" softkey.
4. Press the "Manage view" softkey.
5. Press the "New view" softkey.

6. Activate the checkbox "Display parameter / use setting data", if you also wish to display the new user view in the "Parameter" → "Setting data" → "Data lists".
7. Enter a name for the user view.
8. Confirm with "OK".

7.10.1 Creating a user view

Procedure

1. Select the "Start-up" operating area and press the "Mach. data" softkey.

2. Press the softkeys "User views",
"Manage view" and

"New view".
The "New View" window opens.

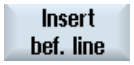
3. Enter the desired view name.
Press the "OK" softkey.

If a user view already exists with the same name, you receive a safety prompt as to whether the existing view should be overwritten.

4. Press the "Enter data" softkey.
The "Insert data" selection box opens.

5. Open the selection list with the <INSERT> key, select a machine data area and press the <INPUT> key.

Select a machine data item with the cursor keys or using the "Find" softkey.



6. Press the "Insert before line" or "Insert after line" softkey to insert the selected machine data at the required position in the user view.

Note:

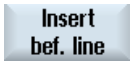
You can navigate in the open user view with the mouse and select a line without closing the list box.

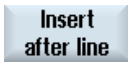
7. Press the "Back" softkey to close the list box and return to the user view you want to edit.

   Your entries are automatically stored.

8. Press the "Insert text" softkey to insert any text in the open user view.

   The "Insert Text" input window opens.





9. Enter a text and explanatory description for the text and press the "Insert before line" or "Insert after line" softkey to accept the text.

10. Press the "Back" softkey to save your entries and return to the user view you are editing.

Selecting a particular machine data item

You can use the Search dialog box to look for a particular data item.

7.10.2 Editing the user view

Depending on the row you have selected, you can use the "Properties" softkey to change comments and, in the case of machine data, the data source (channel, axis, drive unit) and view the description and, if required, change.

- Machine data

  Depending on the data type you can select either a fixed or a variable data source for machine data.

  The entry "variable(*)" means that when you can select another data source (channel, axis, drive unit) with vertical softkeys 1- 3 (+, - and direct selection) the value displayed changes to refer to the data source currently selected.

  Alternately, you can select a fixed data source so that the displayed value does not change when you select a different data source.

- Comment texts

  Text and description

Procedure

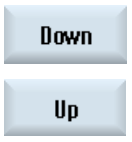
1. Select the "Start-up" operating area and press the "Mach. data" softkey.

2. Press the "User views" softkey.
   The "User Views" window opens.

3. Press the "Edit view" softkey. Additional softkeys to edit the user view are listed.

4. Press the "Insert data" softkey if you wish to enter another data item.

5. Select a machine data item with the cursor keys.



6. Press the "Up" or "Down" softkeys to move the selected row.

   - OR -

   Press the "Delete line" softkey to remove the selected line from the view. The data item is removed without a prompt.

   - OR -

   Press the "Properties" softkey to view the texts for comments and, if required, change.
   The "Properties" window is opened. For machine data, depending on the setting, the description or the machine data is displayed in the lower left-hand window.

7. Press the "Back" softkey to save your changes.

Selecting a particular machine data item

You can use the Search dialog box to look for a particular data item.

Press the "Go to start" softkey to start the search at the first entry.

Press the "Go to end" softkey to start the search at the last entry.

Press the "Continue search" softkey if the data found during the search does not match up with what you are looking for.

7.10.3 Deleting a user view

Procedure

1. Select the "Start-up" operating area.

2. press the "Machine data" softkey.

3. Press the "User views" softkey.

4. Press the "Manage view" softkey.

5. Select the desired view from the selection list.

6. Press the "Delete view" softkey.

With the final confirmation prompt you will be requested to confirm with either "Yes" or cancel with "No".

or

The "User views" dialog is then redisplayed.

Just like before, as an alternative, it is possible to delete a user view under "System data" under the following path: `../user/sinumerik/hmi/template/user_views`

7.11 Plain texts for machine and setting data

Application-specific and language-dependent plain texts can be configured for machine and setting data depending on the version [Index].

Displaying the plain texts

You set the display of the plain texts using the following display machine data:

MD9900 $MM_MD_TEXT_SWITCH	Plain texts instead of MD identifier
= 1	Plain text is displayed in the table
= 0	Plain text is displayed in the dialog line

Files

File	Machine/setting data
nctea_xxx.txt	General machine/setting data
chtea_xxx.txt	Channel-specific machine/setting data
axtea_xxx.txt	Axis-specific machine/setting data
hmitea_xxx.txt	Display machine data

For "xxx" the specified language code must be used, e.g. "deu" for German, "eng" for English, etc.
Supported languages (Page 513)

Ensure that the file names are written in lower case letters.

Procedure

1. Depending on the machine or setting data for which you wish to change the plain text, create the corresponding file, e.g. "nctea_xxx.txt".
2. Save the file with the UTF-8 coding in order that umlauts and special characters are correctly displayed in SINUMERIK Operate.
3. Place the file in SINUMERIK Operate in the following directory:
   System CF card/**user**/sinumerik/hmi/lng or
   System CF card/**oem**/sinumerik/hmi/lng or
   System CF card/**addon**/sinumerik/hmi/lng

Note

The files are searched through in the sequence of the directories "user", "oem" and "addon". The first file that is found is evaluated. If, e.g. text files are available in the "user" and "oem" directories, the files are evaluated in the "user" directory.

Note

If a machine data item has different indices and you do not specify an index for the plain text, the same plain text appears for all the indices of the machine data item.

The parameters and indices must be sorted in an ascending order.

Example of a file with German texts

```
14510 Mein Integer-Text für PLC_MD 14510

14510[1] Mein Integer-Text für MD 14510[1]

14512[1] Mein Text für HEX-Datum 14512[1]
```

Result in the display

The plain text is displayed in the table or in the diagnostics line in the operating area "Startup", "General MD".

Machine data	Text
14510	My integer text for PLC_MD 14510
14510[1]	My integer text for MD 14510[1]
14512[1]	My text in HEX data 14512[1]

Customizing the "Machine" operating area 8

Automatic changeover

The circumstances under which an automatic changeover is made into the "Machine" operating area are set in MD51040 $MNS_SWITCH_TO_MACHINE_MASK.

MD51040 $MNS_SWITCH_TO_MACHINE_MASK	0 (default setting)
Bit 0 = 1	For program selection in the Program Manager, an automatic change is not made into the Machine operating area.
Bit 1 = 1	For program selection in the Program Manager, an automatic change is not made into the Machine operating area. When changing over the operating mode via the machine control panel, an automatic change is not made into the Machine operating area.
Bit 2 = 1	For program selection in the Program operating area, an automatic change is not made into the Machine operating area.
Bit 3 = 1	When selecting a program/executing a program in the Program operating area, the block search is not automatically started.

8.1 Setting the font size of the actual value display

Setting font size

The actual values for the machine coordinate system or workpiece coordinate system can be displayed in two different font sizes in the "Machine" operating area.

Using a channel machine data item, you can set how many axes should be displayed in a larger font.

MD52010 $MCS_DISP_NUM_AXIS_BIG_FONT	Number of actual values with a large font
= 3	Number of actual values with a larger font (default setting)

8.2 Inserting a user-specific logo

OEM-specific logo

The Siemens logo is visible in the header of the "Machine" operating area.

You can replace the Siemens logo with your own logo.

Procedure:

1. Name your own logo "`logo.png`".
2. Save your own logo depending on the bitmap size, in one of the directories: /**oem**/sinumerik/hmi/ico or /**user**/sinumerik/hmi/ico

Directory	Bitmap size
/Ico640	122 x 19
/Ico800	160 x 24
/Ico1024	199 x 30

8.3 Configuring the display of the G-code groups

The "G-functions" pane is visible in the "Machine" operating area.

Up to a maximum of 16 G-code groups are displayed in this pane. Configure the "slmagcodeconfig.ini" file accordingly to determine which G-code groups should be displayed, and where.

Configuring G-code groups

Section	Meaning
Selected G groups	This area is intended for operation of the controller in Siemens mode.
Selected G groups ISO mode	This area is intended for operation of the controller in ISO mode.

Enter the G-code group and position as follows:

SelectedGGroupN = M	
N	Position where G-code group M will be displayed. If you want to leave a position empty, omit the number (M), e.g. "`SelectedGGroup1 = `"
M	The number of the G-code group to be displayed at position N

Structure of the file

```
[Selected G-Groups]
SelectedGGroup1 = 1
SelectedGGroup2 = 2
SelectedGGroup3 = 3
SelectedGGroup4 = 4
SelectedGGroup5 = 5
SelectedGGroup6 = 6
SelectedGGroup7 = 7
SelectedGGroup8 = 8
SelectedGGroup9 = 9
SelectedGGroup10 = 11
SelectedGGroup12 = 12
SelectedGGroup13 = 13
SelectedGGroup14 = 14
SelectedGGroup15 = 15
SelectedGGroup16 = 16
[Selected G-Groups ISO-Mode]
... (as with section for Siemens)
```

Procedure

1. Copy the "slmagcodeconfig.ini" file from the folder /**siemens**/sinumerik/hmi/template/cfg.
2. Place the file in the following directory: /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg. As soon as the file is located in the user-specific directory, the entries for this file take precedence over the Siemens file. If an entry is missing in a user-specific file, the corresponding entry from the Siemens file is used instead.
3. Open the file and enter the number of the G code in question at the required position "`SelectedGGroup1 =` **5**".
   I.e. the 5th G code group will be displayed at the 1st position.

8.4 Configuring the channel operational message

Overview

The channel operational messages are displayed in the third line of the header in the "Machine" operating area. There are two types of channel operational messages:

1. Channel operational messages that require an operator action to continue a program, e.g. feed enable missing, M01 active.

   The channel operational messages are identified by exclamation marks.

2. Channel operational messages that do not require an operator action to continue a program. A stop condition is active for a length of time (>1 s) and is interrupted by the program processing, e.g. dwell time active, waiting for tool change.

   The channel operational message is identified by a clock icon and disappears after a certain time.

File

The settings for this are specified in the "slmahdconfig.ini" file.

Configuring the channel operational message

Section	Meaning
CondStopIcons	Specification of an icon that is to be displayed with a certain channel operational message. If no icon is specified for a certain channel operational message, then the icon specified for "DefaultIcon" is displayed.
CondDelayTime	Specification of how long (in milliseconds) a certain message must be present before it is displayed. • If no time is specified for a certain channel operational message, then the time specified at "CondDelayTime" is used. • If the channel operational message is to be displayed immediately, "0" must be specified as time.

Procedure

1. Copy the "slmahdconfig.ini" file from the /**siemens**/sinumerik/hmi/template/cfg directory.
2. Place the file in the following directory: /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg.
3. Open the file and make the required settings.

"slmahdconfig.ini" file

Standard configuration

```
[CondStopIcons]
Default icon = condwait.png
1 =    condstop.png        ; No NC ready
2 =    condstop.png        ; No mode group ready
3 =    condstop.png        ; EMERGENCY STOP active
4 =    condstop.png        ; Alarm with stop active
5 =    condstop.png        ; M0/M1 active
6 =    condstop.png        ; Block in SBL mode terminated
7 =    condstop.png        ; NC stop active
8 =    condstop.png        ; Read-in enable missing
9 =    condstop.png        ; Feed enable missing
10 =   condwait.png        ; Dwell time active
11 =   condwait.png        ; Aux. function acknowledgment missing
12 =   condstop.png        ; Axis enable missing
13 =   condwait.png        ; Exact stop not reached
14 =   condwait.png        ; Waiting for positioning axis
15 =   condwait.png        ; Waiting for spindle
15 =   condwait.png        ; Waiting for other channel
17 =   condstop.png        ; Waiting for feedrate override
18 =   condstop.png        ; Error in NC block
19 =   condstop.png        ; Waiting for external NC blocks
20 =   condwait.png        ; Waiting for synchronized action
21 =   condwait.png        ; Block search active
22 =   condstop.png        ; Spindle enable missing
23 =   condstop.png        ; Axis feedrate override
24 =   condwait.png        ; Waiting for tool change acknowledgment
25 =   condwait.png        ; Gear step change
26 =   condwait.png        ; Waiting for position control
27 =   condwait.png        ; Waiting for thread cut
28 =   condwait.png        ; Reserved
29 =   condwait.png        ; Waiting for punching
30 =   condwait.png        ; Waiting for safe operation
31 =   condwait.png        ; No channel ready
32 =   condstop.png        ; Oscillation active
33 =   condwait.png        ; Axis replacement active
34 =   condwait.png        ; Axis container rotation
35 =   condwait.png        ; AXCT: Following axis active
36 =   condwait.png        ; AXCT: Leading axis active
37 =   condwait.png        ; AXCT: Follow-up active
38 =   condwait.png        ; AXCT: Internal status change
39 =   condwait.png        ; AXCT: Axis/spindle disable
40 =   condwait.png        ; AXCT: Corr. motion active
41 =   condwait.png        ; AXCT: Axis replacement active
42 =   condwait.png        ; AXCT: Axis interpolator active
43 =   condwait.png        ; Waiting for compile cycle
44 =   condwait.png        ; Access to system variable
45 =   condstop.png        ; Search target found
46 =   condwait.png        ; Rapid retraction started
47 =   condwait.png        ; AXCT: Wait for spindle stop
48 =   condwait.png        ; Machine data match
49 =   condwait.png        ; Axis replacement: Axis coupled
50 =   condwait.png        ; Axis replacement: Liftfast active
51 =   condwait.png        ; Axis replacement: New config active
52 =   condwait.png        ; Axis replacement: AXCTSW active
53 =   condwait.png        ; Axis replacement: Waitp active
54 =   condwait.png        ; Axis in another channel
55 =   condwait.png        ; Axis replacement: Axis is PLC axis
56 =   condwait.png        ; Axis replacement: Axis is oscillating axis
57 =   condwait.png        ; Axis replacement: Axis is Jog axis
58 =   condwait.png        ; Axis replacement: Command axis
58 =   condwait.png        ; Axis replacement: Axis is OEM axis
60 =   condwait.png        ; Coupled following axis
61 =   condwait.png        ; Coupled-motion following axis
62 =   condwait.png        ; Coupled slave axis
```

```
63 =   condstop.png        ; Stop at cycle end M0
64 =   condstop.png        ; Stop at cycle end M1
65 =   condwait.png        ; Wait: Axis is at fixed stop
66 =   condwait.png        ; Master-slave switchover active
67 =   condwait.png        ; Axis replacement: Axis is single axis
68 =   condstop.png        ; Stop: Target reached after block search
69 =   condwait.png        ; Synchronism: Synchronous spindle
70 =   condwait.png        ; Deactivation position synch. spindle
71 =   condwait.png        ; Waiting for transformer axis enable
72 =   condstop.png        ; Waiting because of possible collision
73 =   condstop.png        ; Jog: Position reached
74 =   condstop.png        ; Jog: Direction blocked
75 =   condwait.png        ; Brake request
76 =   condwait.png        ; Wait: G4 still: U
77 =   condstop.png        ; Axial feed disable from PLC
78 =   condstop.png        ; Waiting for axial feed enable
79 =   condwait.png        ; Axial feed disable from SYNACT
80 =   condwait.png        ; Waiting for master spindle speed
81 =   condwait.png        ; Waiting for parameter set change
82 =   condwait.png        ; Waiting for end of motion before transformation change
83 =   condwait.png

84 =   condwait.png

85 =   condwait.png
```

```
[CondDelayTime]
Default delay time = 1000
1 = 0                ; No NC ready
2 = 0                ; No mode group ready
3 = 0                ; EMERGENCY STOP active
4 = 0                ; Alarm with stop active
5 = 0                ; M0/M1 active
6 = 0                ; Block in SBL mode terminated
7 = 0                ; NC stop active
8 = 0                ; Read-in enable missing
9 = 0                ; Feed enable missing
10 = 0               ; Dwell time active
12 = 0               ; Axis enable missing
16 = 0               ; Waiting for other channel
17 = 0               ; Waiting for feedrate override
18 = 0               ; Error in NC block
19 = 0               ; Waiting for external NC blocks
22 = 0               ; Spindle enable missing
23 = 0               ; Axis feedrate override
32 = 0               ; Oscillation active
45 = 0               ; Search target found
76 = 0               ; Wait: G64 still U
```

8.5 Deactivating program test

There are several program test options to test and run-in a part program that are executed using the "Program Test" function.

This function is active as standard. You can select the program test in the "Machine" operating area, in the "Program control" window and using the "PRT" check box.

Deactivating the program test

You can deactivate the program test using the following configuration machine data. "PRT" is no longer displayed in the status line.

MD51039 $MNS_PROGRAM_CONTROL_MODE_MASK		Options for machine - program control
Bit 0 = 0	Function program test not available	

The test option is described in the following documentation:

References

Function Manual, Basic Functions, Mode Group, Channel, Program Operation, Reset Behavior (K1)

8.6 Activating the "Teach In" function

Activate teach in

The teach in function is activated in part via the general configuration machine data.

Settings

MD51034 $MNS_TEACH_MODE	
Bit 0 = 1	The "Teach progr." softkey is displayed. The approached position is accepted into the program with the "Accept" softkey, default value.
Bit 1 = 1	The acceptance of the teach-in block can be blocked by the PLC. DB19.DBX13.0 = 0 Block is accepted DB19.DBX13.0 = 1 Block is not accepted

Access to the function still depends on access rights.

MD51045 $MNS_ACCESS_TEACH_IN	Protection level TEACH IN
= 7	The protection level for the execution of traversing movements to MDA buffer/part program for TEACH IN is specified, default value.

MD51050 $MNS_ACCESS_WRITE_PROGRAM	Protection level write part program
= 7	The protection level for writing part programs is specified, default value.

Set the channelspecific machine data:

MD20700 $MC_REFP_NC_START_LOCK	NC-Start disable without reference point
= 0	

Activating teach in

1. Set the machine data and initiate a reset.
2. Now change into the "AUTO" and "MDA" operating mode.
3. Select the TEACHIN sub-operating mode.
4. Press the "Teach prog." softkey.

Teach in not active

If the "Prog. teach in" softkey is not active, the reasons can be as follows:

- The program is not in the stop, reset or interrupt state.
- Not all of the axes that require referencing are referenced.

Accept STAT and TU

If you wish to accept the joint position of the machine and position of the rotary axes in the traversing block, then click on the "STAT" and "TU" check boxes.

In order that the check boxes are displayed, set the following general configuration machine data:

MD51032 $MNS_STAT_DISPLAY_BASE	Numerical basis for display of the joint position STAT
= 1	Display, joint position STAT

MD51033 $MNS_TU_DISPLAY_BASE	Numerical basis, display of the position of the rotary axes TU
= 1	Display, position of the rotary axes TU

8.7 Block search

8.7.1 Activating block search mode

Block search mode settings

The following machine data can be used to set the possible variants for the block search with G-code programming:

MD51028 $MNS_BLOCK_SEARCH_MODE_MASK	Bit mask for the available search modes
Bit 0 = 1	Block search with calculation, without approach
Bit 1 = 1	Block search with calculation, with approach
Bit 4 = 1	Block search without calculation
Bit 5 = 1	Block search with test run

The following machine data can be used to set the possible variants for the block search in a JobShop program (ShopMill, ShopTurn):

MD51024 $MNS_BLOCK_SEARCH_MODE_MASK_JS	Bit mask for the available search modes (ShopMill, ShopTurn, single-channel)
Bit 0 = 1	Block search with calculation, without approach (default setting)
Bit 1 = 1	Block search with calculation, with approach
Bit 3 = 1	Skip EXTCALL programs
Bit 5 = 1	Block search with test run

8.7.2 Accelerated block search for execution from external

The accelerated block search function allows you to run the part program forward until you reach the block you require.

Settings

If you activate the "Skip EXCALL" function, then you must set the following general configuration machine data:

MD51028 $MNS_BLOCK_SEARCH_MODE_MASK	Bit mask for the available search modes
Bit 3 = 1 (33H to 3BH)	

For an external main program, a block search without calculation is always a fast block search. Only the blocks from the search position are loaded.

8.8 Multi-channel support

In the "Machine" operating area, a dual channel view is possible for any two channels (2 from n) of a mode group.

Using the multi-channel editor, for a multi-channel machine, you can open, change or generate programs simultaneously that are independent of one another from a time perspective. In this case, the programs involved are displayed next to one another in the editor.

Further, you have the option of simulating the programs before they are actually processed at your control.

In addition, you can align the programs according to synchronization points.

Precondition

- Multi-channel data only involve machines where the first technology is turning.
- For multi-channel machine, the following data must be the same for all channels:
  - Measurement unit
  - Work offset (e.g. G54)
  - Z value of the work offset (optional)
  - Blank
  - Speed limitation
- Further, the following JobShop-specific data must be the same for all channels:
  - Retraction plane (one each for the main and counterspindle)
  - Tailstock (one each for the main and counterspindle)
  - Tool change point (one each for the main and counterspindle)
  - Safety clearance
  - Climbing/ and conventional

Creating a multi-channel program

For multi-channel machining, you require a job list with the following data:

- Program names
- Program type
- G code
- ShopTurn program
- Channel assignment

Software option

You require the "ShopMill/ShopTurn" option to generate and edit ShopTurn/ShopMill programs.

After you have created a job list, in the "multi-channel data" parameter screen, you can combine the data from the G code and JobShop, which is then saved as cycle call in the job list. The "multi-channel data" parameter screen is displayed as soon as at least one ShopTurn program is contained in a job list.

Only programming G code programs

If the job list only contains G code programs, then you can deactivate the "multi-channel data" function. To do this, set the following machine data:

MD51228 $MNS_FUNCTION_MASK_TECH	Cross-technology function mask
Bit 0	G code programming without multi-channel data
= 1	Multi-channel data are not listed for job lists that only contain G code programs. The "multi-channel data" softkey is not displayed.

Simulation and simultaneous recording 9

9.1 Overview

Simulation

Simulation is supported with its own program interpreter (SNCK) and a separate simulation-data environment in SINUMERIK Operate. The SNCK considers the complete syntax of the SINUMERIK controller family, including the possibility of incorporating special user options on the machine by comparing data with the NCK environment. The simulation data can be matched statically as required with the NCK environment (initialization data, macros, user data, tool data, machining cycles) or also dynamically when tool data or machining cycles are changed.

Machining simulations, with emphasis on the drilling, milling and turning technologies, can be performed in the workpiece coordinate system for certain machine kinematics on the user interface of the controller:

- The simulation of the finished part is performed with the real NC data.
- The NC data is automatically compared at each change of the part program.
- The simulation allows a dynamic representation of the machining, even for active 5-axis transformation (TRAORI) and swiveled planes.
- Simulation of up to four machining channels for turning machines with B axis.
- Intelligent determination of the block times and the program execution time.
- Very fast graphical representation through the continuous refinement of the workpiece.
- Optimum resolution for each selected picture area.
- Any sections are possible.
- In parallel to the machining of one workpiece, the machining of another workpiece can be simulated (as of NCU 720.x).
- 3D simulation 1 (option): In addition, the simulation can be extended to 3D representation. This extension also applies to the simultaneous recording.

Restrictions

- Very fast simulation result, this means, however, low dynamic resolution.
- For complex representations, fine recording is too slow or does not run for very complex parts.
- The simulation cannot be used for compile cycles with special kinematics.
- Blank CAD data cannot be imported (for example, for castings).

- Couplings cannot be simulated (coupled motion, axial master-value coupling, electronic gearbox):
  - Coupled motion: TRAILON(<following axis>, <leading axis>, <coupling factor>)
  - Axial master-value coupling: LEADON(Faxis, LAxis, curve table n) actual-value and setpoint coupling
  - Electronic gearbox: EGDEF(FA, LA1, coupl.1, LA2, coupl.2, ... LA5, coupl.5), EGON, EGONSYN, EGONSYNE
- Synchronization with axis replacement (GET, GETD) cannot be simulated. This means a time estimate is also not possible!
- If parallel processing is performed in channel 1 and channel 2 (revolutional feed with spindle from 2nd channel), the program execution in the simulation does not match that of the automatic program (simultaneous recording).
- The representation of the workpiece is incorrect for swiveled planes (CYCLE800).

Simultaneous recording

During machining, the tool paths can be simultaneously recorded on the display of the controller in a three-side view or 3D view. Workpiece graphics and views correspond to the graphic simulation.

Note

To prevent an incomplete representation, you must activate the simultaneous recording prior to the NC start.

9.2 Configuring the simulation

Displaying machining operations

Turning technology

- Conventional turning with two geometry axes
- Three spindles: Main spindle, counterspindle, tool spindle
- Counterspindle slides, tailstock as NC axis
- B axis: Aligning turning tools in the tool spindle

Milling on turning machines

- Milling with geometry axes: TRANSMIT, TRACYL, TRAANG

Milling technology

- Milling with five axes: Swivel/TRAORI
- Swivel head change

Configuring the simulation

Set the turning or milling technology and the corresponding coordinate system in the channel via the following channel-specific machine data:

Turning technology:

MD52200 $MCS_TECHNOLOGY	Technology
= 1	Turning technology

MD52000 $MCS_DISP_COORDINATE_SYSTEM	Position of the coordinate system
= 34 (example)	

Milling technology:

MD52200 $MCS_TECHNOLOGY	Technology
= 2	Milling technology

MD52000 $MCS_DISP_COORDINATE_SYSTEM	Position of the coordinate system
= 0 (example)	

Meaning of the axes

MD52206 $MCS_AXIS_USAGE[n]	Meaning of the axes in the channel [n] channel axis number
= 0	No special meaning
= 1	Tool spindle (driven tool)
= 2	Auxiliary spindle (driven tool)
= 3	Main spindle (turning)
= 4	C axis of the main spindle (turning)
= 5	Counterspindle (turning)
= 6	C axis of the counterspindle (turning)
= 7	Linear axis of the counterspindle (turning)
= 8	Tailstock (turning)
= 9	Back rest (turning)

Enter the direction of rotation for the rotary axes that are not configured in a toolholder or a 5-axis transformation via the following channel-specific machine data.

MD52207 $MCS_AXIS_USAGE_ATTRIB[n]	Attributes of the axes [n] channel axis number
Bit 0	Rotation around 1st geometry axis (for rotary axes)
Bit 1	Rotation around 2nd geometry axis (for rotary axes)
Bit 2	Rotation around 3rd geometry axis (for rotary axes)
Bit 3	Reversal of direction of rotation (for rotary axes)

MD52290 $MCS_SIM_DISPLAY_CONFIG	Position of the status display of the channel in the simulation. This MD only acts on OP019.
Bit 0	Upper left-hand corner
Bit 1	Upper right-hand corner
Bit 2	Lower left-hand corner
Bit 3	Lower right-hand corner

In the channel-specific machine data, for at least one geometry axis per channel enter a value other than 0.0, e.g. 0.001. If the value is 0.0, the system assumes that this parameter has still not been set.

MD53230 $MCS_SIM_START_POSITION	Axis position when starting the simulation
Simulation is only possible if a value not equal to 0 has been set for at least one geometry axis.	

Software option

You require the following option for further simulation settings:

"3D simulation 1 (finished part)".

Note

Program start in the simulation

If MD22622 $MCS_DISABLE_PLC_START is set in a channel, then the channel is not automatically started in the simulation. It can then only be started from another channel using the part program command "START".

Note

Alarm display in the simulation

Alarms are output in the simulation exactly the same way as alarms in the normal program execution, but no more than five alarms are displayed (above the graphic, to distinguish them from the machine alarms).

If a different error signaling behavior (e.g. syntax error) occurs between simultaneous recording and simulation, then, for example, the reason can be due to the hardware access operations in the programming. The simulation does not access the hardware, however, internally it reads the input with 0 and is then exited. On the other hand, for simultaneous recording, an alarm is output.

Deactivating simulation

The following machine data must be set to deactivate the simulation:

MD51226 $MNS_FUNCTION_MASK_SIM	Simulation function screen
Bit 1 = 1	Deactivating simulation

9.3 Reset NCK data for the simulation

If an alarm, designated with the Power On symbol occurs during simulation, then you must reset the simulation and then reload again.

Procedure

1. Select the "Start-up" operating area.

2. Press the "HMI" softkey.

3. Press the ">>" and "Simulation general reset" softkeys.

   The "NOTICE! Power On Reset" window is opened and you receive a confirmation prompt: "Do you really want to completely initialize the simulation again?"

4. Press the "OK" softkey.

   A general reset of the simulation is initiated with a complete data alignment with the real NCK.

Note

If you read-in an archive into the NCK, the general reset is automatically initiated.

9.4 Configuring the simultaneous recording

Configuring the simultaneous recording

Software option

For the "Simultaneous recording" function, you require the option:
"Simultaneous recording (real-time simulation)".

Software option

You require the "ShopMill/ShopTurn" option to display the tailstock

Activating the tailstock display

Procedure:

1. Make the tailstock visible through selection in the program.
2. Specify the tailstock dimensions: In the operating area, select "Parameters" → "Setting data" → "Spindle chuck data". Enter parameters "ZR" and "XR" for the tailstock length and tailstock diameter.

   The tailstock dimensions are written into the following machine data:

MD52218 $MCS_FUNCTION_MASK_TURN	Turning function screen
Bit 2 = 1	Tailstock enable: The tailstock becomes visible if selected in the "tailstock" program.

MD53240 $MAS_ SPINDLE_PARAMETER[i]	Spindle chuck data in mm
[0]: Chuck dimension [1]: Stop dimension [2]: Jaw dimensions	

MD53241 $MAS_ SPINDLE_CHUCK_TYPE	Spindle jaw type
0 = clamp from the outside 1 = clamp from the inside	

MD53242 $MAS_TAILSTOCK_PARAMETER[i]	Tailstock data in mm
[0]: Tailstock dimension [1]: Tailstock length	

Activating the machining time display

Timers are provided as system variables in the Program runtime function. While the NCK-specific timers are always activated (for time measurements since the last controller power-up), the channel-specific timers must be started via the following channel-specific machine data.

MD27860 $MC_PROCESS_TIMERMODE	Activating the program runtime measurement.
Bit 0 = 1	The measurement of the total runtime for all part programs is active ($AC_OPERATING_TIME).
Bit 1 = 1	The measurement of the actual program runtime is active ($AC_CYCLE_TIME).
Bit 4 = 1	Measurement also during active dry run feedrate.
Bit 5 = 1	Measurement during program test.

PLC functions

10

10.1 Program selection

10.1.1 Displaying the softkey

The softkeys on the user interface for calling the program lists are activated via general configuration machine data.

Configuring a softkey

MD51041 $MNS_ENABLE_PROGLIST_USER	
0	No softkey
1	The "Prog. list" softkey is displayed

MD51043 $MNS_ENABLE_PROGLIST_MANUFACT	
0	No softkey
1	The "MANUFACTURER" softkey is displayed

Precondition

To create program lists, you require the following authorization:

- "Program manager" operating area: Access level 3 (password: User) or
- "Start-up" operating area: Access level 1 (password: Manufacturer).

Program lists

You can create a program list by combining desired programs from the NC data, e.g. workpieces, part programs and subprograms. These programs can then be selected by the PLC for execution.

Program lists	Directory
plc_proglist_user.ppl	/**user**/sinumerik/hmi/plc/programlist
plc_proglist_manufacturer.ppl	/**oem**/sinumerik/hmi/plc/programlist

Procedure

1. Select the "Start-up" operating area if you have the authorization for access level 1 (password: Manufacturer).

   - OR -

   Select the "Program manager" operating area if you have the authorization for access level 3 (password: User).

2. Press the menu forward key and the "Prog. list" softkey.

   The "Program List" window opens.

3. Press the "Manufacturer" softkey if you want to create a program list that can be used for all machines of a certain series.

4. Place the cursor in the desired line (program number).

5. Press the "Select program" softkey.

   The "Programs" window opens. The data tree of the NC memory with the directories "Workpieces", "Part programs" and "Subprograms" is displayed.

6. Place the cursor on the desired program and press the "OK" softkey.

   The selected program is inserted in the first line of the list together with its path.

   - OR -

   Enter the program name directly in the list.

   If you are making entries manually, check that the path is correct (e.g. //NC/WKS.DIR/MEINPROGRAMM.WPD/MEINPROGRAMM.MPF).

   If required, the extension (.MPF) is added.

   Note:

   A syntax check is not performed.

   With workpieces, make sure that there is a main program or a job list with the same name in the workpiece itself.

7. To remove a program from the list, place the cursor on the appropriate line and press the "Delete" softkey.

   - OR -

   To delete all programs from the program list, press the "Delete all" softkey.

10.1.2 Program selection from the PLC

Function

The NC program to be executed can be specified via the PLC. The names of the NC programs are entered in program lists.

There are two types of program lists that are dependent on the access level where NC programs are combined into different files:

1. user: Editing possible by the user (access level 3).
2. manufacturer: Editing possible only by the manufacturer (access level 1).

Access rights	Index	Program lists	Directory
user	1	plc_proglist_user.ppl	/**user**/sinumerik/hmi/plc/programlist
	2	reserved	
manufacturer	3	plc_proglist_manufacturer.ppl	/**oem**/sinumerik/hmi/plc/programlist

Changing the name of the program list:

If the name of a program list is changed, a control file with the "plc_proglist_main.ppl" name must be created.

Depending on the access rights, the control file is saved in the directory /**oem**/sinumerik/hmi/plc/programlist or /**user**/sinumerik/hmi/plc/programlist. The index and the modified name must be entered into the control file.

Interface signals

Table 10- 1 Jobs from the PLC to HMI; perform a program selection in the NC:

DB19.DBB13 (PLC → HMI)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Part program			reserved				Disable teach transfer
Selection	Download	Unload					

Table 10- 2 The job is specified using an index in the control file:

DB19.DBB16 (PLC → HMI)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Always 1 = passive file system	PLC index for control file; value 1 or 3						

Table 10- 3 An index in the specified program list refers to the NC program:

DB19.DBB17 (PLC → HMI)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Part program handling: Index of the file to be transferred from the program list. user = value 1 - 100 oem = value 201 - 255							

Table 10- 4 Acknowledgment byte from HMI for the current data transfer status:

DB19.DBB26 (HMI → PLC)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Part program				Active	Error	OK	reserved
Selection	Download	Unload					

Job processing

A PLC job is processed according to the following scheme:

- The PLC may only initiate a job in the job byte if the acknowledgment byte is 0.
- The HMI mirrors the job (excluding the parameter set) in the acknowledgment byte (signaling to the PLC that its job is being processed). The PLC receives a "job active" signal for an unfinished job.
- Once the operation is finished (without error or with error), the PLC must respond again and delete the job byte.
- The HMI then sets the acknowledgement byte to 0. This ensures a sequential procedure.

Error IDs at the PLC

DB19.DBB27 (HMI → PLC)	
Value	**Meaning**
0	No error
1	Invalid number for the control file (value in DB19.DBB16 < 127 or invalid).
3	Control file "plc_proglist_main.ppl" not found (value in DB19.DBB16 invalid).
4	Invalid index in control file (incorrect value in DB19.DBB17).
5	Job list in the selected workpiece could not be opened.
6	Error in job list (job list interpreter returns error).
7	Job list interpreter returns empty job list.

References

Function Manual Basic Functions: Various NC/PLC interface signals and functions (A2)

10.2 Activating the key lock

The operator panel keyboard and a keyboard connected to the HMI can be locked via an interface signal.

Interface signal

DB19	Signals to operator panel front (PLC -> HMI)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Part program handling: Index of the file to be transferred from the user list.							
DBB0						Key lock On		

DB19	Signals to operator panel front (PLC -> 2nd HMI)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Part program handling: Index of the file to be transferred from the user list.							
DBB50						Key lock On		

10.3 Transferring the area and screen number to the PLC

Archiving the active operating area in the PLC user interface

For the subsequently listed operating areas, the specified PLC-IDs are saved in the variable DB19.DBB21 of the PLC user interface when selecting the operating areas.

If an HMI monitor is configured, the PLC-ID is saved in byte 0 of the HMI monitor.

Operating area	PLC_ID (DB19.DBB21)
Machine	201
Parameters	205
Programming	203
Program Manager	202
Diagnostics	204
Commissioning	206

Saving the selected window in the PLC user interface

For the windows subsequently listed, when selecting the screen, the specified PLC-IDs are saved in the variable DB19.DBW24 of the PLC user interface.

If an HMI monitor is configured, then the PLC-ID is saved in bytes 2 and 3 of the HMI monitor.

Machine operating area

Window name				PLC-ID - DB19.DBW24
AUTO	Starting screen			200
	Program control			210
	Block search			220
	Settings for the automatic mode			250
MDA	Starting screen			20
JOG	Starting screen			19
	Settings for manual operation			1
	T,S,M			2
	Softkey: "Position"	Target position		4
	Softkey: "Measure tool"	Length, manual		16
		Radius, manual		17
		Softkey: "Length, auto"	Length, auto	13
		Diameter/radius auto		14
		Probe calibration		15
	Softkey: "Set WO"			21
	Softkey: "Measure tool"	Calibration fixed point		52
		Length, manual		51
		Length, auto		58
		Probe calibration		56
	Softkey: "Workpiece zero"	Setting the edge		5
		Aligning the edge		31
		Distance 2 edges		32
		Right-angled corner		33
		Any corner		8
		1 hole		9
		2 holes		35
		3 holes		36
		4 holes		37
		Rectangular pocket		34
		Rectangular spigot		38
		1 circular spigot		10
		2 circular spigots		39
		3 circular spigots		40
		4 circular spigots		41
		Aligning the plane		11
	Softkey: "Swivel"	Swivel plane		60

Parameters operating area

Window name		PLC-ID, DB19.DBW24
Tool list		600
Tool wear		610
OEM list		620
Magazine		630
Work offsets		640
R parameters		650
Global user variables		682
Local user variables (LUD)		681
Channel-specific user variables		683
Local user variables (LUD/PUD)		684
Softkey: "Setting data"	Spindles	670

Program Manager operating area

Window name	PLC-ID, DB19.DBW24
NC	300
Local drive	325
Configured drive1	330
Configured drive2	340
Configured drive3	350
Configured drive4	360
Configured drive5	383
Configured drive6	384
Configured drive7	385
Configured drive8	386

Diagnostics operating area

Window name	PLC-ID, DB19.DBW24
Alarms	500
Messages	501
Alarm log	502

10.4 HMI monitor

The HMI monitor is a data area in a freely-selectable user-specific PLC data block.

Configuring HMI monitors

The PLC address of the HMI monitor is configured using the following display machine data:

MD9032 $MM_HMI_MONITOR	Determining the PLC data for HMI monitor information
Byte 0	Saves the PLC-ID of the active operating area.
Byte 2 Byte 3	Saves the PLC-ID of the window that is currently selected.

The machine data is a string and is interpreted as a pointer to a PLC data area with specified byte offset, e.g. DB60.DBB10. The PLC data area encompasses 8 bytes of the PLC. The start address must have an even byte offset (0, 2, 4, 6, 8, etc.).

Example

DB60.DBB10 for data block 60, byte 10

Reserves the bytes 10, 11, 12, 13, 14, 15, 16, 17 as HMI monitor

DB60.DBB10: PLC-ID of the active operating area

DB60.DBW12: PLC-ID of the window that is currently selected

Note

When using the HMI monitor, the corresponding variables in the PLC user interface – DB19.DBB21 and DB19.DBW24 – are no longer supplied.

This means that either the user interface or the HMI monitor can be used – but not both simultaneously.

10.5 User status display (OEM)

Function

User icons can be displayed in the Machine operating area in the second line in the header. In this case, the program name is displayed in the right-hand field of the third line in the header. Active hold conditions hide the program name.

The display of the user icons is controlled via PLC bits. The icons are provided in the form of PNG files and stored resolution-specifically in the file system at:
`/user/sinumerik/hmi/ico/ico640`, etc. **Maximum 16 positions are available in the header** to display the user icons.

Configuration

The user icons are configured in the `slmahdconfig.ini` file in Section [UserIcons]. The following data is required:

- The start address of the PLC double word with the bits to control the display of the user icons.
- For each bit used, the file name of the icon and the position at which the icon should be displayed.

Alternatively, you can use the following parameters for the definition:

- **USER_ICON_BASE**

  This means that 32 bits are available with UI_0 (highest bit) to UI_31 (lowest bit).

  Example: USER_ICON_BASE=DB80.DBB0

  ⇒ UI_0 = DB80DBX3.0 and UI_31 = DB80.DBX0.7

- **USER_ICON_BASE256**

  This means that 256 bits are available with UI_0 (highest bit) to UI_255 (lowest bit).

  Example: USER_ICON_BASE256=DB19.DBB80

  ⇒ UI_0 = DB19.DBX111.0 and UI_255 = DB19.DBX80.7

Example

```
[UserIcons]
USER_ICON_BASE=DB19.DBB80
; set the start byte of the PLC double word that displays the icons (DB19.DBD80)
UI_0 = icon1.png,4
; show icon1.png on position 4 if bit 0 (DB19.DBX83.0) is set
UI_1 = icon2.png,6
; show icon2.png on position 6 if bit 1 (DB19.DBX83.1) is set
```

Superimposition

With a **non-unique** selection (bits for multiple identifiers whose image is to be displayed at the same position):

The image with the lower identifier number is superimposed with the image with the higher identifier number for the same position. Non-unique selection can also be used with less than 16 active selection bits. The PLC can deliberately use this superimposition to overlay less important displays (with lower identifier numbers) with important displays (high identifier numbers).

Note

If two HMI applications are assigned to one NC/PLC unit (M:N), the PLC must first determine from the interface which of the HMI interfaces is active. Icons can be requested by the PLC for the active HMI application only.

Possible applications

With a **unique selection**, a maximum of 16 bits are set simultaneously in the four selection bytes for each of the different positions.

- 32 alternative images for a position, each selected with a different bit (currently only one active selection bit)
- Two alternative images for each of the permissible 16 positions, each position requires two of the 32 selection bits (maximum 16 active selection bits at any one time)
- Combination thereof with a maximum total of 32 images for the maximum 16 positions (maximum of 16 active selection bits at any one time)
- More than 16 selection bits.

Configuring OEM texts

Machine manufacturers can display their own texts in the program directory and program name lines. These texts cannot include % parameters as is possible in user texts. The lines are divided into <OEM_NUMBER_TEXTFIELD> areas according to the entry in HEADER.INI.

The data is provided in a user data block. The number of the data block and the exact offset are declared in the HEADER.INI file. The following entries are available in the [OEMTextInfo] section for this purpose:

```
[OEMTextInfo]

OEM_NUMBER_TEXTFIELD = 1 ; maximum of 3 text fields per line

OEM_TEXT_BASE = DBx.DBBy
```

The interface in the user DB has the following format:

Start-DBB byte or Start-DBB +18 byte	Bit0=1: there is something to do All bits=1: job is acknowledged by HMI All bits=0: PLC can write to interface again.
Start-DBB +1 word or Start-DBB +19 word	Offset for text from alpu_xx.com to be displayed; 700 000 is the base address and is always summed internally. All bits=0: Delete line
Start-DBB + 3 string or Start DBB+20 double Word	String containing a maximum of 12 characters

The first parameter contains an offset for a text number with a base of 700,000 (user PLC texts). If this parameter = 0, the corresponding line is deleted. The second parameter contains a maximum 12-character string. Unless empty, this text is output instead of the user PLC text.

The parameters must be written from "back to front" in the PLC, i.e. all parameters must be initialized before the first byte is set. The data for the next line is located exactly 18 bytes after the start byte. The lines are output from left to right; a maximum of three output fields per line are provided (i.e. a total of six fields are possible).

A hotlink to the first byte for each line is set up in the operating software. If a change occurs in that byte, the operating software responds. If the operating software displayed the data, it writes a -1 to the first variable. The operating software is informed about this change by means of the hotlink, whereupon it writes a 0 to this variable.

The HMI itself does not have to react to this change. The PLC can only write data to the interface again if the variable is set to 0. This mechanism ensures that the operating software knows about all parameter changes.

Configuring OEM icons

OEM icons indicating the machine state can be output in the field provided for the program control display (e.g. SBL, M01, etc.). If OEM icons are defined, the elements for the program control display are hidden.

The icon names are identified in the HEADER.INI configuration file, similar to user icons:

```
[OemIcons]
 OI_0= <name.png>, <position>
 ...
 OI_31= <name.png>, <position>
```

Here, <name> is the file name of the bit map and <Position> is the output position (from 1 to 16) in the display line. Multiple bit maps can be output at the same position. If more than one bit map is active simultaneously at the same position, the bit map with the highest screen number is displayed.

The output is controlled by means of a PLC double word. This double word is declared in the next section in the HEADER.INI file:

```
[OemIcons]

 Oem_ICON_BASE = DBx.DBBy
```

Each bit in this double word represents exactly one OEM icon corresponding to the screen number. Thus, if bit 0 is set, bit map OI_0 is displayed. If a bit is reset, the associated bit map is deleted.

A maximum of 16 icons can be displayed, enabling a total of 16 display positions. Empty positions need not be specified.

Spindle functions

11

11.1 Spindle control

References

For a detailed description to configure the spindle, see

Function Manual Basic Machine: Spindles (S1)

End of program

The following M functions are used for the end of program:

M function from MD10714 $MN_M_NO_FCT_EOP	Main program end	Spindle continues to run
M2, M30	End of main program and return jump to beginning of program	Spindle stops
M17	End of subprogram and return jump into the main program	Spindle continues to run

If machine data MD10714 $MN_M_NO_FCT_EOP is not equal to zero, then a distinction is made between M2 / M30 (program end of an NC program) and the M function set in MD10714 $MN_M_NO_FCT_EOP.

Example

MD10714 $MN_M_NO_FCT_EOP = 32 means "M32" for the program end of a program generated in the "JOG" or "MDA" operating mode.

Among other things, this functionality is required in order to continuously start the spindle in manual operation (e.g. for scratching).

Configuring keys

If you implement a manual control using the keys on the machine control panel, then this is realized via the following interface signals in the spindle data block:

DB3x.DBX30.0	Spindle stop
DB3x.DBX30.1	Spindle start clockwise rotation
DB3x.DBX30.2	Spindle start, counter-clockwise rotation

The spindle can be started and stopped in the following state:

DB21.DBX35.7= 1	Channel in reset state
DB21.DBX35.6 = 1	Channel state interrupted
DB21.DBX35.3 = 1	Program state interrupted

Note

If the spindle must be stopped when the program is running, then set the interface signal DB3x.DBX4.3, "Feed stop/spindle stop" in the user PLC.

Additional settings:

MD11450 $MN_SEARCH_RUN_MODE		Search run parameterization
Bit 1 = 1	Automatic ASUB start after output of the action blocks (see also MD11620 $MN_PROG_EVENT_NAME). Alarm 10208 is not output until the ASUB is completed.	

Direction of rotation (only for ShopTurn)

In the ShopTurn user interface, ensure that the direction of rotation of the spindle and C axis is correctly displayed and when programming ShopTurn functions, that the correct direction of rotation is executed. You must base these settings on the actual direction of rotation of the spindle/C axis on the machine.

- If you use the functions cylinder surface transformation and face machining, then a precondition is that the function was correctly commissioned.
  See Cylinder surface transformation (TRACYL) under ShopTurn (Page 507)
- The direction of rotation of the spindle/C axis for the M function M3 that is displayed in the ShopTurn interface is defined in part using machine data:
  See: Defining the direction of rotation in Section: Setting-up ShopTurn cycles for turning (Page 503)
- The spindle direction of rotation (M3/ M4) is assigned to the positive direction of rotation of the C axis via the interface signal DB3n.DBX17.6. The bit defines whether M3 and C+ rotate in the same direction (= 0) or in opposite directions (= 1). The corresponding setting options can be found in the following sections:
  - Direction of rotation of counter-spindle Setting up the counterspindle under ShopTurn (Page 504)
  - Direction of rotation of main spindle Setting-up ShopTurn cycles for turning (Page 503)

11.2 Analog spindle

Machine axis index for analog spindle

For a spindle which is not assigned to any drive (FD, MSD, SLM), the power display can be controlled via the PLC.

In order that the operating software identifies the spindle as analog spindle, enter the axis index of the analog spindle in the following machine data:

MD51068 $MNS_SPIND_DRIVELOAD_FROM_PLC1	Machine axis index spindle 1 Utilization display from the PLC
Machine axis index of a spindle (analog) that draws the data for the utilization display in the T,F,S window from the PLC (DB19.DBB6).	

MD51069 $MNS_SPIND_DRIVELOAD_FROM_PLC2	Machine axis index spindle 2 Utilization display from the PLC
Machine axis index of a spindle (analog) that draws the data for the utilization display in the T,F,S window from the PLC (DB19.DBB7).	

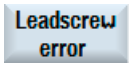
11.3 Leadscrew error compensation

Instead of transferring the compensation data via the part program or INI file to the NC, you can enter and check the compensation data for all axes or change the configuration in an input screen.

Finally, the changed data is activated in the NC in one step. The machine data required when activating is set automatically.

Procedure

1. Select the "Start-up" operating area and press the "NC" softkey.



2. Press the "Leadscrew error" softkey.

   The "Values of the Compensation Tables" window opens and displays the default compensation tables for an axis or, if no compensation values are available, the measuring system used.

3. Press the "Axis +" or "Axis -" softkey to select the desired axis.

- OR -

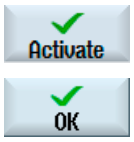
Press the "Select axis" softkey.

The "Axis Direct Selection" window opens. Position the cursor on the desired axis and confirm with "OK".

4. Press the "Configuration" softkey to edit the compensation values for a selected axis.

   The "Configuration of the Compensation Tables" window opens.

5. Enter the following:
   - Type of compensation: EEC or CEC.
   - Start position, end position and interpolation point spacing.
   - Only for EEC:
     Used measuring system - if several measuring systems are available, select the desired system from the selection menu.
   - Only for CEC:
     – Compensation table (-): Index of the table in the negative direction.
     – Compensation table (+): Index of the table in the positive direction.



6. Confirm your entries with the "Activate" softkey.

   A dialog box to carry out a NC warm restart is then displayed to activate the compensation. Confirm with "OK".

   The "Values of the Compensation Tables" window opens.

7. Enter the desired compensation values for each interpolation point.

8. Press the "Activate" softkey again to transfer the compensation values to the NC.

References

Extended Functions (K3) Function Manual

Drive system

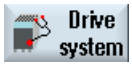
12

12.1 Commissioning of drives

Procedure

Once commissioning of the PLC has been completed, you can carry out commissioning of the SINAMICS drives via the user interface of SINUMERIK Operate.

1. Select the "Start-up" operating area.



2. Press the "Drive system" softkey.
   The "Drive system overview" window opens.
   A message is output whether the drive system has already been commissioned or not.

References

The procedure for commissioning the SINAMICS drives is described in the following documentation:

CNC Commissioning Manual: NCK, PLC, drive

Tool management 13

13.1 Machine data for tool management

13.1.1 Settings with/without magazine management

Setting without magazine management

Make the following settings if you are commissioning the tool management **without** NC magazine management:

MD18080 $MN_MM_TOOL_MANAGEMENT_MASK	Memory for the tool management is reserved step-by-step (SRAM).
= 02H	
Bit 1	Provide monitoring data.

MD20310 $MC_TOOL_MANAGEMENT_MASK	Activating the tool management functions.
= 02H	
Bit 1	Monitoring functions of tool management active.

MD17530 $MN_TOOL_DATA_CHANGE_COUNTER	Marking the changed tool data for HMI.
= 1FH	
Bit 0	Tool status change.
Bit 1	Tool remaining unit quantity change.
Bit 2	Tool data change service.
Bit 3	Magazine data in the change service.
Bit 4	ISO data in the change service.

MD28450 $MC_MM_TOOL_DATA_CHG_BUFF_SIZE	Buffer for changing tool data (DRAM).
= 100	Number of entries in the buffer for the OPI change service for tool data. Dynamic memory is used. This buffer is only created if either bit 2 or bit 3 is set in MD17530 $MN_TOOL_DATA_CHANGE_COUNTER.

MD19320 $ON_TECHNO_FUNCTION_MASK	
=2000000H	
Bit 25	Enables the tool monitoring function without magazine management.

Setting with magazine management

Make the following settings if you are commissioning the tool management **with** NC magazine management:

MD18080 $MN_MM_TOOL_MANAGEMENT_MASK	Memory for the tool management is reserved step-by-step (SRAM).
= 03H	
Bit 0	Provide tool management data.
Bit 1	Provide monitoring data.

MD20310 $MC_TOOL_MANAGEMENT_MASK	Activating the tool management functions.
= 03H	
Bit 0	Magazine management active.
Bit 1	Monitoring functions of tool management active.

MD17530 $MN_TOOL_DATA_CHANGE_COUNTER	Marking the changed tool data for HMI.
= 1FH	
Bit 0	Tool status change.
Bit 1	Tool remaining unit quantity change.
Bit 2	Tool data change service.
Bit 3	Magazine data in the change service.
Bit 4	ISO data in the change service.

MD28450 $MC_MM_TOOL_DATA_CHG_BUFF_SIZE	Buffer for changing tool data (DRAM).
= 100	Number of entries in the buffer for the OPI change service for tool data. Dynamic memory is used. This buffer is only created if either bit 2 or bit 3 is set in MD17530 $MN_TOOL_DATA_CHANGE_COUNTER.

MD19320 $ON_TECHNO_FUNCTION_MASK	
= 10H	
Bit 4	Enables the tool monitoring function with magazine management.

13.1.2 Configuring the access levels of the tool management

Access levels for selected parameters

MD51199 $MNS_ACCESS_WRITE_TM_GRIND	Access level, write TM grinding data.
MD51200 $MNS_ACCESS_WRITE_TM_GEO	Access level, write TM geometry data.
MD51201 $MNS_ACCESS_WRITE_TM_WEAR	Access level, write TM wear data.
MD51202 $MNS_ACCESS_WRITE_TM_WEAR_DELTA	Access level, restricted writing of tool wear values.
MD51203 $MNS_ACCESS_WRITE_TM_SC	Access level, write TM additive offsets.
MD51204 $MNS_ACCESS_WRITE_TM_EC	Access level, write TM operating offsets.
MD51205 $MNS_ACCESS_WRITE_TM_SUPVIS	Access level, write TM monitoring data.
MD51206 $MNS_ACCESS_WRITE_TM_ASSDNO	Access level, write TM unique D number.
MD51207 $MNS_ACCESS_WRITE_TM_WGROUP	Access level, write TM wear groups (magazine location / magazine).
MD51208 $MNS_ACCESS_WRITE_TM_ADAPT	Access level, write TM tool adapter geometry data.
MD51209 $MNS_ACCESS_WRITE_TM_NAME	Access level, write TM tool name and duplo.
MD51210 $MNS_ACCESS_WRITE_TM_TYPE	Access level, write TM tool type.

The access level of individual parameters can be overlaid through settings in the <PARAMETERCONFIGURATION> tag, "Access level" entry (see SectionConfigure the list parameters (Page 147)).

Access level for the "Further Details" window

MD51215 $MNS_ACCESS_WRITE_TM_ALL_PARAM	Access level, TM details - write all parameters.

Access levels for certain functions of the tool management

MD51216 $MNS_ACCESS_TM_TOOL_CREATE	Access level, TM, create tool.
MD51217 $MNS_ACCESS_TM_TOOL_DELETE	Access level, TM, delete tool.
MD51218 $MNS_ACCESS_TM_TOOL_LOAD	Access level, TM, load tool.
MD51219 $MNS_ACCESS_TM_TOOL_UNLOAD	Access level, TM, unload tool.
MD51220 $MNS_ACCESS_TM_TOOL_MOVE	Access level, TM, move tool.
MD51221 $MNS_ACCESS_TM_TOOL_REACTIVATE	Access level, TM, reactivate tool.
MD51222 $MNS_ACCESS_TM_TOOL_MEASURE	Access level, TM, measure tool.
MD51223 $MNS_ACCESS_TM_TOOLEDGE_CREATE	Access level, TM, create tool cutting edge.

MD51224 $MNS_ACCESS_TM_TOOLEDGE_DELETE	Access level, TM, delete tool cutting edge.
MD51225 $MNS_ACCESS_TM_MAGAZINE_POS	Access level, TM, position magazine.

13.1.3 Additional settings

Additional settings

You can enable further functions on the user interface via the following machine data / setting data:

MD52270 $MCS_TM_FUNCTION_MASK	
Bit 0	Creating tool at the magazine location is not permitted.
Bit 1	Load/unload lock if the machine is not in the reset state.
Bit 2	Load/unload lock for EMERGENCY OFF
Bit 3	Loading/unloading or relocating tool in/out of spindle locked.
Bit 4	Tool loaded directly into spindle.
Bit 5	Using the grinding configuration file.
Bit 6	Relocating a tool in/out of spindle is permitted despite lock (see bit 3).
Bit 7	Tool is created using the number.
Bit 8	Hide tool relocation.
Bit 9	Hide magazine positioning.
Bit 10	Reactivate tool with magazine positioning.
Bit 11	Reactivate tool in all monitoring types.
Bit 12	Hide reactivating tool.

SD54215 $SNS_TM_FUNCTION_MASK_SET	
Bit 0	Diameter display for rotating tools. Cutting edge parameters 6 (tool nose radius) and 15 (wear radius) are not displayed as a radius value, but as a diameter value for the following tool types: Types 100 to 299, 580, 710, 711, 712, 713, 714 and 725. Cutting edge parameter 7 (outside radius) is not displayed as a radius value, but as a diameter value for the following tool types: Types 140 and 714.
Bit 1	M4 is the standard direction of rotation for all turning tools. When creating turning tools, the direction of rotation is pre-assigned with M4.
Bit 2	A name is not suggested when creating a tool.
Bit 3	Input lock, tool name and tool type for loaded tools. For loaded tools, the tool name and the tool type can no longer be changed.
Bit 4	Input lock for loaded tools if the channel is not in the reset state.
Bit 5	Tool wear entries are added: Wear data is entered in addition to the already existing wear value.
Bit 6	Only numerical entries are permitted in the "Tool identifier".

Bit 7	Hide tool monitoring parameters. The tool monitoring parameters are hidden in the user interface.
Bit 8	Diameter display for face axis - geometry. The geometry value of the transverse axis is displayed as a diameter value, if a transverse axis is defined in MD20100 $DIAMETER_AX_DEF and SD42940 $TOOL_LENGTH_CONST is set to 18 and SD42950 $TOOL_LENGTH_TYPE is set to 2.
Bit 9	Diameter display for face axis - wear. The wear value of the transverse axis is displayed as a diameter value, if a transverse axis is defined in MD20100 $DIAMETER_AX_DEF and SD42940 $TOOL_LENGTH_CONST is set to 18 and SD42950 $TOOL_LENGTH_TYPE is set to 2.
Bit 10	Enable tool load/relocate to buffer storage locations. The magazine number can be entered into the load dialog box. It is therefore possible to access the buffer storage via magazine number 9998.
Bit 11	Creating new tools at gripper locations is blocked.
Bit 12	Measuring tools are not unloaded with the "Unload all" function.

Dependencies

The setting data SD54215 $TM_FUNCTION_MASK_SET and the machine data MD20360 $TOOL_PARAMETER_DEF_MASK have the following dependencies:

Dependency			Description	Recommendation
SD54215	⇔	MD20360		
Bit 9	⇔	Bit 0	If bit 0 is set in MD20360, then SD54215 bit 9 has no effect because the NC already returns the linear wear value of the transverse axis as a diameter value.	It is recommended that the setting MD20360 bit 0 and bit 1 not be used. **Instead, use SD4215 bit 9 and bit 8**. MD20360 bit 0 and bit 1 are effective only for turning and grinding tools. This setting therefore cannot be used on a turning/milling machine because the linear component of the transverse axis applies for turning tools in the diameter and for milling tools in the radius. When the setting data is used, only the display goes to diameter, the internal value in the NC remains at radius.
Bit 8	⇔	Bit 1	If bit 1 is set in MD20360, then SD54215 bit 8 has no effect because the NC already returns the linear geometry value of the transverse axis as a diameter value.	
Bit 0	⇔	Bit 11	If bit 11 is set in MD20360, then SD54215 bit 0 has no effect with regard to cutting edge parameter 6 (tool nose radius) because the NC already returns the tool nose radius as a diameter value.	It is recommended that the setting MD20360 bit 11 and bit 12 not be used. **Instead, set bit 0 in SD54215.** MD20360 bit 11 and bit 12 apply to all tool types, i.e. also to turning tools. This setting therefore cannot be used on a turning/milling machine because the tool nose radius of a turning tool should never be specified in the diameter. When the setting data is used, only the display goes to diameter, the internal value in the NC remains at radius.
Bit 0	⇔	Bit 12	If bit 12 is set in MD20360, then SD54215 bit 0 has no effect with regard to cutting edge parameter 15 (wear radius) because the NC already returns the wear radius as a diameter value.	

Enabling the multitool function

MD18080 $MN_MM_TOOL_MANAGEMENT_MASK	
Bit 10=1	The multitool function is available

Enabling the graphical tool and magazine display function

MD52271 $MCS_TM_MAG_PLACE_DISTANCE	Distance between individual magazine locations in the unit of measurement of the basic NC system.
> 0	The tools and magazine locations are displayed graphically.
= 0	The tools and magazine locations are not displayed graphically.

Supplementary conditions:

- MD52200 $MCS_TECHNOLOGY = 2 (milling) and MD52201 $MCS_TECHNOLOGY_EXTENSION = 0
- Multitool function is not enabled.

Input limits for wear input

MD51212 $MNS_TM_WRITE_WEAR_ABS_LIMIT	Maximum value of the tool wear.
MD51213 $MNS_TM_WRITE_WEAR_DELTA_LIMIT	Maximum differential value of restricted tool wear input.
MD51214 $MNS_TM_WRITE_LIMIT_MASK	Range of validity of the restricted tool wear input.

13.2 Configuring the user interface

Configurable settings

The following settings can be configured:

- Configure the tool lists
- Configure the list parameters
- Configure tool types
- Configure the "Additional Data" window
- Configure the "New Tool - Favorites" window
- Assign a name for magazines and magazine locations
- Assign magazines to channels

The following sections explain how you configure these adaptations.

Requirement for grinding technology

Set the "Universal" technology and set:
MD52270 $MN_TM_FUNCTION_MASK bit 5 = 1.

Only the grinding tool types can be then selected on the user interface.

Procedure

1. Open the directory: /**siemens**/sinumerik/hmi/template/cfg
2. Copy the "oem_sltmlistconfig.xml" template file

NOTICE
Other template for the grinding technology The "sltmaddgrindinglistconfig.xml" template is used to expand a turning configuration by adding grinding tools. Copy the file from the directory: /**siemens**/sinumerik/hmi/template/cfg

3. Copy the file to the directory /**oem**/sinumerik/hmi/cfg

   OR: /**user**/sinumerik/hmi/cfg
4. Change the file name according to the set technology:

File name	Technology
sltmlistconfig.xml	Milling technology
sltmturninglistconfig.xml	Turning technology
sltmplclistconfig.xml	PLC tool management "TRANSLINE 2000"
sltmgrindinglistconfig.xml	Grinding technology

5. Remove the comments of the example in the template to create your specific configuration

Configuration examples

Examples for all possible configurations are provided in the template oem_sltmlistconfig.xml, which are described individually in the following sections:

```
 <?xml version="1.0" encoding="UTF-8" standalone="yes"?>
- <CONFIGURATION>
<!--  ************************************************************-->
<!--  enter your configuration behind this comment -->
<!--  ************************************************************ -->

 Configuration examples

<!--  ************************************************************ -->
<!--  enter your configuration ahead this comment -->
<!--  ************************************************************ -->
 </CONFIGURATION>
```

Enter your configuration using the following xml identifiers:

Identifier <tag>	for the following setting:
<SETTINGS>	General settings (Page 129)
<LISTCONFIGURATION>	Configure the tool lists (Page 134)
<PARAMETERCONFIGURATION>	Configure the list parameters (Page 147)
<TOOLTYPECONFIGURATION>	Configure tool types (Page 153)
<MOREDATACONFIGURATION>	Configuring the "More data" window (Page 154)
<NEWTOOLFAVORITECONFIGURATION>	Configure the "New tool - favorites" window (Page 156)
<NEWTOOLCONFIGURATION>	Configuring the "New Tool" window (Page 156)
<NEWTOOLDEFAULTVALUECONFIGURATION>	Configuring default values for new tools (Page 157)
<DETAILSCONFIGURATION>	Configuring the "Details" window (Page 161)
<MAGAZINEPLACENAMECONFIGURATION>	Assigning a name for magazines and magazine locations (Page 161)
<PLACETYPECONFIGURATION>	Assigning a name for magazine location types (Page 163)
<CHANNELMAGAZINEASSIGNMENT>	Assignment of magazines to channels (Page 164)
<TOOLCHANGEREASON>	Reason for the tool change when reactivating (Page 169)

13.2.1 General settings

<SETTINGS> tag

The general settings for the tool management user interface are stored in the <SETTINGS> tag.

Entries	Meaning
ReactivateWithMagPos	True - reactivate with positioning of the tool to the tool magazine loading point. False - default setting, reactivate without positioning the tool magazine.
ReactivateAllMonitorModes	True - the actual values of all the monitoring types set in the NC are reset. False - default setting, actual value of the active monitoring type is reset.
ReactivateEnabled	True - default setting, reactivation is enabled. False - reactivation is disabled.
CreateNewToolDialog	True - the "New Tool" window is displayed. In this window, before actually creating the tool, you can enter the tool name, tool location type and the size left and right in half locations. False - default setting, the "New Tool" window is not displayed. Once the name has been entered, the tool will be created directly in the tool list.
CreateNewMultiToolDialog	True - default setting, the "New Multitool" window is displayed. In this window, you can configure the following before actually creating the multitool: • Multitool names • Number of multitool locations • Type of clearance input • Value of the location clearance for each multitool location False - the "New Multitool" window is not displayed. Once the name has been entered, the multitool will be created directly in the tool list.

Entries	Meaning
MagazineSelectionDialog	True - a dialog box displaying the buffer, tool magazine and NC memory is displayed. A mark can be added to or removed from each of these elements to indicate whether that element appears in the list display. The "Go to" softkey can be used to select an element directly in the list display. False - no dialog box for magazine selection. The system switches between the buffer, the tool magazines and the NC memory. If there is no MagazineSelectionDialog entry in the <`Settings`> tag, the dialog box is automatically displayed with more than one tool magazine (excluding the system magazine) when magazine configuration is taking place. If there is only one tool magazine, the switchover function is used.
NewToolFavoritesOnly	Refers to the "New tool" function. True - only those tool types that are configured as favorites are listed. False - default setting, all tool types are listed.
SortationInFirstEtcLevel	True - the "Sorting" function is placed at the first softkey level. The "Continue" function is omitted. False - default setting, sorting at all softkey levels.
ToolBufferOnceOnTop	True - default setting, buffer is displayed at the start of the list. False - buffer is displayed for each magazine. Only those locations are displayed that are assigned to the magazine.
UnloadToolFromLoadPlaceEnabled	True - a tool at the load position can be removed from the load position using the "Unload" softkey. False - default setting. The "Unload" softkey is not displayed for a tool at the load position.
AutoHNumberDisplayEnabled	Column of the cutting parameter "IsoHNoDPH - ISO H number" depending on the machine configuration. True - default setting, the column is automatically displayed. False - the column is not automatically displayed.
AutoUniqueDNumberDisplayEnabled	Column of the cutting edge parameter "UniqueDNo" depending on the machine configuration. True - default setting, the column is automatically displayed. False - the column is not automatically displayed.
AccessLevelDeleteAllDNos	The following entry specifies the access level as of which the "Delete all D numbers delete" function is offered. Default setting: Access level 3 (user) - relevant only when the "Unique D number" setting has been made.
MagazineNumberOfDCheckAndActivate	Magazine number to which the D check (check for unique D number) and Activate (activation of a wear group) are to be applied. Default setting: -2 Meaning: All magazines that are connected to a toolholder or a spindle.

Entries	Meaning
AutoFixedPlaceDisplayEnabled	Column of the tool parameter "ToolStateFixed" - tool status - tool is fixed-location coded and acts dependent on the magazine configuration. True - default setting, the column is automatically hidden, if all of the configured magazines are fixed location coded. False - the column is not automatically hidden.
MagPlaceAdapterDisplayEnabled	Columns of the magazine location adapter parameters are displayed in the "Magazine" window. False - default setting, parameters are not displayed.
AdaptTransDataViewEnabled	The magazine location adapter transformed display of the cutting edge parameters is enabled. It can be switched on and off in the settings dialog of the tool lists. False - default setting, the magazine location adapter transformed display of the cutting edge parameters is not enabled.
ActiveCompensationsEnabled	The "Working offsets" function is enabled. This function depends on the machine configuration. Unique D number, magazine location adapter and magazine management must be set. False - default setting, the "Working offsets" function is not enabled.
M2NLockEnabled	Locking of an M to N switchover while a function of the tool management is being executed. True - default setting, switchover is locked.
AccessLevelWriteDetailsAllParameter	The following entry specifies the access level as of which write access applies in the "Details - All Parameters" window. Default setting: Access level 7 (keyswitch position 0) - can be overlaid through the setting in MD51215.
AccessLevelReadDetailsAllParameter	The following entry specifies the access level as of which the "Further details" function is offered in the "Details" dialog. Default setting: Access level 7 (keyswitch position 0) - can be overlaid through the setting in MD51198.
FixNumberOfMultiToolPlaces	Multitools are created with a fixed number of multitool locations. There is no prompt when you create the multitool.
FixKindOfDistInMultiTools	Multitools are created with a fixed type of clearance input of the multitool locations. There is no prompt when you create the multitool. Possible input value: 3 - clearance of the multitool locations as an angle.
DlDisplayMode	• DisplayDistributed - default setting, the setup offsets EC are displayed in the tool list and the additive offsets SC are displayed in the tool wear list. • EcInWearList - the setup offsets EC are displayed in the tool wear list and the additive offsets SC are not displayed.

Entries	Meaning
CombinedToolMonitoring	Specifies the combined monitoring types offered in the toggle field: • Time/Count - tool life and workpiece count • Time/Wear - tool life and wear monitoring • Count/Wear - workpiece count and wear monitoring • Time/Count/Wear - tool life, workpiece count and wear monitoring
MagazineMoveMessage	True - "Magazine movement running" or "Magazine movement ended" message is displayed. False - default setting, message is not displayed.
ToolLoadErrorMessage	Refers to the output of the fault message due to a negative PLC. True - default setting, the fault message is displayed. False - the fault message is not displayed.

The following settings refer to markings in the lists.

True - marking is displayed.

False - marking is not displayed (default setting).

If several markings apply to one location, the most important information is displayed. For instance, if a tool is locked, and at the same time, the "Tool position" and the "Reference direction holder angle" for this tool do not match, then a red cross is displayed for locked. The yellow triangle for the conflict cannot be seen.

Entries	Meaning
ShowSymbolActivePlace	Marking of the magazine location at the machining position. True - default setting applies for the "Revolver" magazine type. False - setting for all other magazine types.
ShowSymbolActiveMultiToolPlace	Marking of the multitool location at the machining position. Is only displayed when the multitool is located in the spindle or the toolholder. True - default setting.
ShowSymbolLoadPlace	Selection of the magazine location at the loading position. True - default setting applies for all magazine types (except Revolver is true). False - setting for the "Revolver" magazine type.
ShowSymbolChangeInSpindlePlace	Marking of the magazine location at the change position. True - default setting applies for all magazine types (except Revolver is true). False - setting for the "Revolver" magazine type.
ShowSymbolActiveTool	Marking of the active tool. False - default setting.

Entries	Meaning
ShowSymbolProgrammedTool	Marking of the follow-on tool. True - default setting.
ShowSymbolActiveDNo	Marking of the active cutting edge. False - default setting.
ShowSymbolActiveDNoInTool	Marking of the active tool by marking the active cutting edge. True - default setting for configuration without magazine management. False - setting for configuration with magazine management.
ShowSymbolAcitveDlNo	Marking of the active DL number. True - default setting.
ShowConflictPositionAndDirection	Marking of a conflict; tool position and cutting direction do not match. True - default setting.
ShowConflictActiveToolWarning	Marking of a conflict; revolver magazine type and the active tool are not at the the machining position. True - default setting.
ShowSymbolActiveIsoHNoL1	Marking of the active H number for length 1 in the ISO tool list. true: Default setting.
ShowSymbolActiveIsoHNoL2	Marking of the active H number for length 2 in the ISO tool list. True - default setting.
ShowSymbolActiveIsoHNoL3	Marking of the active H number for length 3 in the ISO tool list. True - default setting.
ShowSymbolActiveIsoDNo	Marking of the active D number in the ISO tool list. True - default setting.
ShowSymbolActiveIsoHDNo	Marking of the active HD number in the ISO tool list. True - default setting.

Example

```
<SETTINGS>
     <ReactivateWithMagPos value="false" type="bool" />
     <MagazineMoveMessage value="false" type="bool" />
     <CreateNewToolDialog value="true" type="bool" />
     <MagazineSelectionDialog value="false" type="bool" />
     <AccessLevelWriteDetailsAllParameter value="4" type="int" />
</SETTINGS>
```

13.2.2 Configure the tool lists

<LISTCONFIGURATION> tag

The entries used for configuring the following list views are located in the <LISTCONFIGURATION> tag:

- "Tool List" window, identifier <SlTmToollistForm>, see the 1st example.
- "Tool Wear" window, <SlTmToolwearForm> identifier
- "Magazine" window, <SlTmToolmagazinForm> identifier
- "Tool Data OEM" window, <SlTmTooloemForm> identifier
  This window is hidden in the default configuration. The window is only displayed when you enable it with <Enabled>, see the 2nd example.
- "Tool Selection" window, <SlTmToolselectionForm> identifier: In order to select a tool this window can be displayed in the program input screen.

Entry	Meaning
Enabled	True - window is displayed. False - window is hidden.
CAPTION	Definition of the list name. See 1st example: "Tool list" appears on the user interface for the "TM_CAPTION_TOOLLIST" identifier.
COLUMNX	Column selection: X stands for the column number.
TOOLTYPE_ALL	The column setting applies to all tool types.
TOOLTYPE_XXX	The column setting applies to a particular tool type. XXX stands for the number of the tool type.
EMPTY_MAG_PLACE	The column setting applies to an empty magazine location. Empty magazine locations appear in a list sorted according to magazine.
Item	Identifier of the list parameter. See example: The column in which the magazine number and magazine location are displayed is created for the "ToolInMagInPlace" identifier. Tool parameter identifiers (Page 138) Cutting parameter identifiers (Page 140) Monitoring parameter identifiers (Page 142) Magazine location parameter identifiers (Page 143)
DELETE_COLUMN	Delete column.
INSERT_COLUMN	Insert column.

Example 1: Configuring the magazine list - magazine location and tool location type

Note

The columns of the list configuration cannot be taken from the display in the user interface in all cases because some columns are automatically inserted and therefore not included in the count of the configuration.

Variant 1

Column 10 and column 11 are overwritten. If column 10 and column 11 do not exist, the new columns will be added to the existing columns.

```
<LISTCONFIGURATION>
    <!-- **** Magazine list *** -->
    <SlTmToolmagazinForm>
      <!-- **** Column 10 *** -->
      <COLUMN10>
        <!-- **** For all tool types *** -->
        <TOOLTYPE_ALL>
          <!-- **** Display magazine location type *** -->
          <Item value="MagPlaceType" type="QString" />
        </TOOLTYPE_ALL>
      </COLUMN10>
      <!-- **** Column 11 *** -->
      <COLUMN11>
        <!-- **** For all tool types *** -->
        <TOOLTYPE_ALL>
          <!-- **** Display tool location type *** -->
          <Item value="ToolPlaceSpec" type="QString" />
        </TOOLTYPE_ALL>
        <!-- **** For all multitools *** -->
        <TOOLTYPE_9997>
          <!-- **** Display for all multitool location types *** -->
          <Item value="MultiToolPlaceSpec" type="QString" />
        </TOOLTYPE_9997>
      </COLUMN11>
    </SlTmToolmagazinForm>
</LISTCONFIGURATION>
```

Variant 2

The new columns are inserted in the standard configuration between the "Magazine location locked" and "Oversized tool" columns.

```
<LISTCONFIGURATION>
    <!-- **** Magazine list *** -->
    <SlTmToolmagazinForm>
      <!-- **** Insert column *** -->
      <INSERT_COLUMN>
        <!-- **** Column 7 *** -->
        <COLUMN7>
          <!-- **** For all tool types *** -->
          <TOOLTYPE_ALL>
            <!-- **** Display magazine location type *** -->
            <Item value="MagPlaceType" type="QString" />
          </TOOLTYPE_ALL>
        </COLUMN7>
        <!-- **** Column 8 *** -->
        <COLUMN8>
          <!-- **** For all tool types *** -->
          <TOOLTYPE_ALL>
            <!-- **** Display tool location type *** -->
            <Item value="ToolPlaceSpec" type="QString" />
          </TOOLTYPE_ALL>
          <!-- **** For all multitools *** -->
          <TOOLTYPE_9997>
            <!-- **** Display for all multitool location types *** -->
            <Item value="MultiToolPlaceSpec" type="QString" />
          </TOOLTYPE_9997>
        </COLUMN8>
      </INSERT_COLUMN>
    </SlTmToolmagazinForm>
</LISTCONFIGURATION>
```

Example 2: Configuring the magazine list - "Oversized tool" column is deleted

Note

The columns of the list configuration cannot be taken from the display in the user interface in all cases because some columns are automatically inserted and therefore not included in the count of the configuration.

```
<LISTCONFIGURATION>
    <!-- **** Magazine list *** -->
```

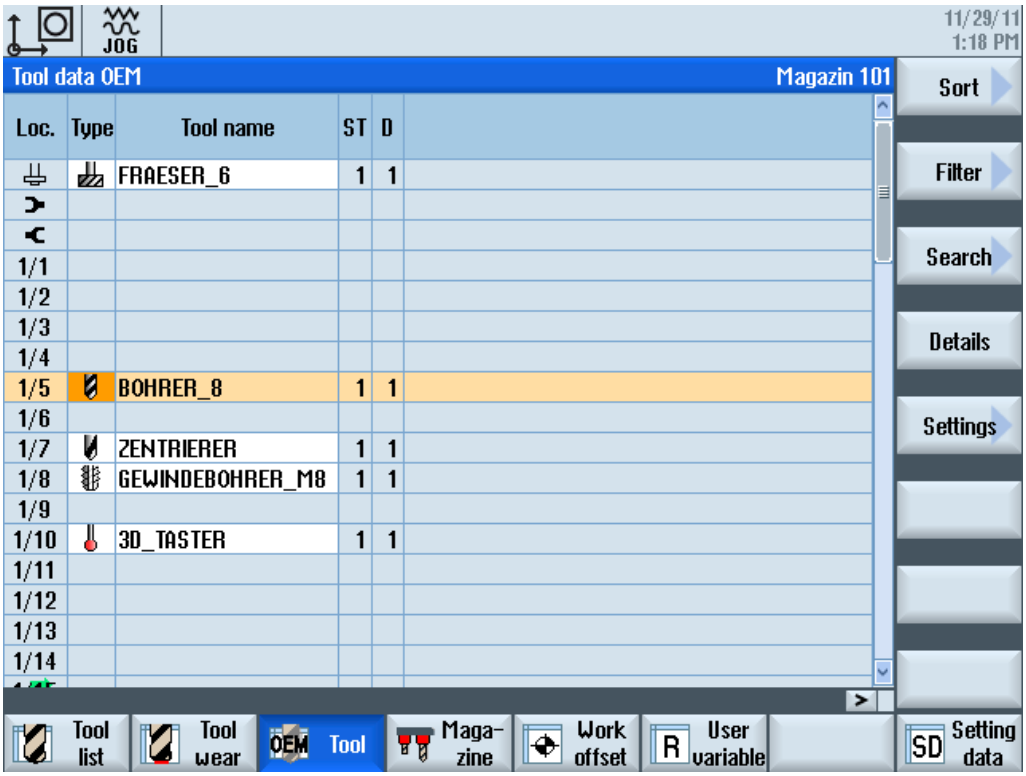
```
    <SlTmToolmagazinForm>
      <!-- **** Delete column 7 *** -->
      <DELETE_COLUMN>
        <COLUMN7 />
      </DELETE_COLUMN>
    </SlTmToolmagazinForm>
</LISTCONFIGURATION>
```

Example 3: Enabling the OEM tool data list

```
<SlTmTooloemForm>
      <Enabled value="true" type="bool" />
</SlTmTooloemForm>
```

Result

- The "OEM Tool Data" window is displayed. It automatically displays the columns shown in the figure.
- The new "OEM tools" softkey appears and can be operated.



13.2.2.1 Tool parameter identifiers

Tool parameters

For the tool parameters, the following identifiers are used in the configuration file:

Identifier	Parameter or property	System variable *)
Empty	Empty field	-
ToolNo	Number of the tool	-
AdaptNo	Adapter number assignment	$TC_MPP8
DuploNo	Duplo number	$TC_TP1
DuploNoRW	Duplo number, read and write access	$TC_TP1
NumCuttEdges	Number of cutting edges of tool	$P_TOOLND
ToolIdent	Tool name	$TC_TP2
ToolIdentRO	Tool name, read only access	$TC_TP2
ToolInfo	Tool information	$TC_TP11
ToolInMag	Magazine in which the tool is located	$A_TOOLMN
ToolInPlace	Magazine location containing the tool	$A_TOOLMLN
ToolInMagInPlace	Magazine number/Magazine location	$A_TOOLMN / $A_TOOL_MLN
ToolMonTCW	Type of tool monitoring, tool life, workpiece count and wear. If wear monitoring has not been enabled via the machine data, this parameter is handled like ToolMonTC.	$TC_TP9
ToolMonTC	Type of tool monitoring, tool life and workpiece count	$TC_TP9
ToolPlaceSpec	Location type	$TC_TP7
ToolPlaceSpecIdent	Location type, if it is to be displayed as text. The precondition is that the text for the location type was configured.	$TC_TP7
ToolSearch	Tool search type for replacement tools	$TC_TP10
ToolMyMag	Owner magazine of the tool	$A_MYMN
ToolMyPlace	Owner magazine location of the tool	$A_MYMLN
ToolSizeLeft	Tool size left in half locations	$TC_TP3
ToolSizeRight	Tool size right in half locations	$TC_TP4
ToolSizeUpper	Tool size upper in half locations	$TC_TP5
ToolSizeDown	Tool size lower in half locations	$TC_TP6
ToolOverSize	Tool size as fixed setting - two half locations left, two half locations right, one half location top, one half location bottom	$TC_TP3 - $TC_TP6
ToolState	Tool status in the hexadecimal notation	$TC_TP8
ToolStateActiv	Tool status - tool active	$TC_TP8, Bit0
ToolStateEnabled	Tool status - tool released	$TC_TP8, Bit1
ToolStateLocked	Tool status - tool locked	$TC_TP8, Bit2
ToolStateLockedRO	Tool status - tool locked, only read access	$TC_TP8, Bit2

Identifier	Parameter or property	System variable *)
ToolStateMeasured	Tool status - tool measured	$TC_TP8, Bit3
ToolStatePrewarn	Tool status - tool has reached prewarning limit	$TC_TP8, Bit4
ToolStatePrewarnRO	Tool status - tool has reached prewarning limit, only read access	$TC_TP8, Bit4
ToolStateInChange	Tool status - tool is being changed	$TC_TP8, Bit5
ToolStateFixed	Tool status - tool fixed place coded	$TC_TP8, Bit6
ToolStateUsed	Tool status - tool was in use	$TC_TP8, Bit7
ToolStateAutoReturn	Tool status - automatic return	$TC_TP8
ToolStateIgnoreLocked	Tool status - do not observe locked	$TC_TP8, Bit9
ToolStateMarkedToUnload	Tool status - tool is marked to unload	$TC_TP8, Bit10
ToolStateMarkedToLoad	Tool status - tool is marked to load	$TC_TP8, Bit11
ToolStatePermanent	Tool status - tool is permanent	$TC_TP8, Bit12
ToolState1To1Exchange	Tool status - one to one replacement	$TC_TP8, Bit14
ToolStateHandTool	Tool status - manual tool	$TC_TP8, Bit15
ToolProtAreaFile	File name of the tool description which is required to define the protection zone	$TC_TP_PROTA
ToolMaxVelo	Maximum speed	$TC_TP_MAX_ VELO
ToolMaxAcc	Maximum acceleration	$TC_TP_MAX_ ACC
ToolInMultiTool	Multitool in which the tool is located	$A_TOOLMTN
ToolInMultiToolPlace	Multitool location containing the tool	$A_TOOLMTLN
ToolMyMultiTool	Owner multitool of the tool	$A_MYMTN
ToolMyMultiToolPlace	Owner multitool location of the tool	$A_MYMTLN
ToolAlarmIsExtended	PLC tool status - function "extended alarm" active	-
ToolAlarmLimit	PLC tool status - alarm limit reached	-
ToolExtAlarmLimit	PLC tool status - limit "extended alarm" reached	-
ToolUser_1, ... ToolUser_10	OEM tool parameters 1 to 10	$TC_TPC1, ... $TC_TPC10
ToolAppl_1, ... ToolAppl_10	Siemens application tool parameters 1 to 10	$TC_TPCS1, ... $TC_TPCS10

*) Parameter corresponds to the system variable or the system variable is the basis for this parameter.

NOTICE

Tool name "ToolIdent"

The maximum length of tool names is 31 ASCII characters.

The number of characters is reduced for Asian characters or Unicode characters.

The following special characters are not permitted: | # "

13.2.2.2 Cutting parameter identifiers

For the cutting parameters, the following identifiers are used in the configuration file:

Identifier	Parameter or property	System variable *)
EdgeNo	D number	-
EdgeNoIdx	Cutting edge number	-
ToolType	Tool type, cutting parameter 1	$TC_DP1
CuttEdgePos	Cutting edge position, cutting parameter 2	$TC_DP2
GeoLength1	Length 1, cutting parameter 3	$TC_DP3
GeoLengthGeoAx1	Length of geometry axis 1, cutting parameter 3, e.g. length X	$TC_DP3
GeoLength	Length, cutting parameter 3	$TC_DP3
GeoLength2	Length 2, cutting parameter 4	$TC_DP4
GeoLengthGeoAx3	Length of geometry axis 3, cutting parameter 4, e.g. length Z	$TC_DP4
GeoLength3	Length 3, cutting parameter 5	$TC_DP5
GeoLengthGeoAx2	Length of geometry axis 2, cutting parameter 5, e.g. length Y	$TC_DP5
GeoRadius	Radius, cutting parameter 6	$TC_DP6
GeoCornerRadius	Corner radius, cutting parameter 7	$TC_DP7
GeoOutsideRadius	Outside radius, cutting parameter 7	$TC_DP7
GeoLength4	Length 4, cutting parameter 8	$TC_DP8
PlateLength	Cutting tip length, cutting parameter 8	$TC_DP8
GeoLength5	Length 5, cutting parameter 9	$TC_DP9
GeoWidth	Width, cutting parameter 9	$TC_DP9
PlateWidth	Cutting tip width, cutting parameter 9	$TC_DP9
GeoPitch	Thread pitch, cutting parameter 9	$TC_DP9
BoreRadius	Hole radius, cutting parameter 9	$TC_DP9
GeoAngle1	Angle 1, cutting parameter 10	$TC_DP10
HolderAngle	Holder angle, cutting parameter 10	$TC_DP10
GeoAngle2	Angle 2, cutting parameter 11	$TC_DP11
AngleConicalMillTool	Angle conical mill tools, cutting parameter 11	$TC_DP11
CuttDirection	Reference direction holder angle, cutting parameter 11	$TC_DP11
WearLength1	Wear length 1, cutting parameter 12	$TC_DP12
WearLengthGeoAx1	Wear length of geometry axis 1, cutting parameter 12, e.g. Δ length X	$TC_DP12
WearLength	Wear length, cutting parameter 12	$TC_DP12
WearLength2	Wear length 2, cutting parameter 13	$TC_DP13
WearLengthGeoAx3	Wear length of geometry axis 3, cutting parameter 13, e.g. Δ length Z	$TC_DP13
WearLength3	Wear length 3, cutting parameter 14	$TC_DP14
WearLengthGeoAx2	Wear length of geometry axis 2, cutting parameter 14, e.g. Δ length Y	$TC_DP14

Identifier	Parameter or property	System variable *)
WearRadius	Wear radius, cutting parameter 15	$TC_DP15
WearCornerRadius	Wear corner radius, cutting parameter 16	$TC_DP16
WearLength4	Wear length 4, cutting parameter 17	$TC_DP17
WearLength5	Wear length 5, cutting parameter 18	$TC_DP18
WearAngle1	Wear angle 1, cutting parameter 19	$TC_DP19
WearAngle2	Wear angle 2, cutting parameter 20	$TC_DP20
AdaptLength1	Adapter length 1, cutting parameter 21	$TC_DP21
AdaptLengthGeoAx1	Adapter length of geometry axis 1, cutting parameter 21, e.g. adapter length X	$TC_DP21
AdaptLength2	Adapter length 2, cutting parameter 22	$TC_DP22
AdaptLengthGeoAx3	Adapter length of geometry axis 3, cutting parameter 22, e.g. adapter length Z	$TC_DP22
AdaptLength3	Adapter length 3, cutting parameter 23	$TC_DP23
AdaptLengthGeoAx2	Adapter length of geometry axis 2, cutting parameter 23, e.g. adapter length Y	$TC_DP23
ReliefAngle	Relief angle, cutting parameter 24	$TC_DP24
PlateAngle	Cutting tip angle, combination of cutting parameter 24 and cutting parameter 10	$TC_DP24 and $TC_DP10
NoseAngle	Nose angle, cutting parameter 24	$TC_DP24
CuttRate	Cutting rate, cutting parameter 25	$TC_DP25
SpindleDirection	For rotating tools, direction of rotation of the tool spindle. For turning tools, direction of rotation of the main spindle	$TC_DP25 bit8 and bit9
Coolant1	Coolant 1	$TC_DP25 Bit10
Coolant2	Coolant 2	$TC_DP25 Bit11
MFunction1	M function 1	$TC_DP25 Bit0
MFunction2	M function 2	$TC_DP25 Bit1
MFunction3	M function 3	$TC_DP25 Bit2
MFunction4	M function 4	$TC_DP25 Bit3
IsoHNoDPH	ISO H number	$TC_DPH
OrientNo	Cutting orientation	$TC_DPV
OrientV1	Cutting orientation vector 1	$TC_DPV3
OrientV2	Cutting orientation vector 2	$TC_DPV4
OrientV3	Cutting orientation vector 3	$TC_DPV5
OrientVGeoAx1	Cutting orientation vector of geometry axis 1, cutting orientation parameter 3, e.g. vector X	$TC_DPVN3
OrientVGeoAx3	Cutting orientation vector of geometry axis 3, cutting orientation parameter 4, e.g. vector Z	$TC_DPVN4
OrientVGeoAx2	Cutting orientation vector of geometry axis 2, cutting orientation parameter 5, e.g. vector Y	$TC_DPVN5
TeethCount	Number of teeth, cutting parameter 34	$TC_DP34
UniqueDNo	Unique D number	$TC_DPCE

Identifier	Parameter or property	System variable *)
EdgeUser_1, ..., EdgeUser_10,	OEM cutting parameters 1 to 10	$TC_DPC1, ... $TC_DPC10
EdgeAppl_1, ..., EdgeAppl_10x	Siemens application cutting parameters 1 to 10	$TC_DPCS1, ... $TC_DPCS10

*) Parameter corresponds to the system variable or the system variable is the basis for this parameter.

13.2.2.3 Monitoring parameter identifiers

For the monitoring parameters, the following identifiers are used in the configuration file:

Identifier	Parameter or property	System variable *)
SupWarning	Warning limits, taking the current monitoring type into consideration	-
SupRemaining	Actual value, taking the current monitoring type into consideration	-
SupDesired	Setpoint, taking the current monitoring type into consideration	-
SupWarningTime	Tool life warning limit	$TC_MOP1
SupRemainingTime	Tool life actual value	$TC_MOP2
SupWarningPieces	Prewarning limit for workpiece count	$TC_MOP3
SupRemainingPieces	Actual value for workpiece count	$TC_MOP4
SupDesiredTime	Setpoint for tool life	$TC_MOP11
SupDesiredPieces	Setpoint for workpiece count	$TC_MOP13
SupWarningWear	Prewarning limit for wear	$TC_MOP5
SupRemainingWear	Actual value for wear	$TC_MOP6
SupDesiredWear	Setpoint for wear	$TC_MOP15
SupExtendedAlarm	PLC tool management: Extended alarm	-
SupWarningPiecesIncremental	PLC tool management: Prewarning limit for workpiece count	$TC_MOP13 - $TC_MOP3
SupActualPieces	PLC tool management: Actual value for workpiece count	$TC_MOP13 - $TC_MOP4
EdgeSupUser_1, ... EdgeSupUser_10	OEM cutting edge monitoring parameters 1 to10	$TC_MOPC1, ... $TC_MOPC10
EdgeSupAppl_1, ... EdgeSupAppl_10	Siemens application cutting edge monitoring parameters 1 to 10	$TC_MOPCS1, ... $TC_MOPCS10

*) Parameter corresponds to the system variable or the system variable is the basis for this parameter.

13.2.2.4 Grinding parameter identifiers

For grinding parameters, the following identifiers are used in the configuration file:

Identifier/parameter	Meaning	System variable *)
GrindingSpindleNo	Spindle number	$TC_TPG1
GrindingConnectionRule	Chaining rule	$TC_TPG2
MinimalDiscRadius	Minimum grinding wheel radius	$TC_TPG3
ActualDiscRadius	Actual grinding wheel radius (read access only)	-
MinimalDiscWidth	Minimum grinding wheel width	$TC_TPG4
ActualDiscWidth	Actual grinding wheel width	$TC_TPG5
MaximalDiscSpeed	Maximum grinding wheel speed	$TC_TPG6
MaximalDiscPeripheralVelocity	Maximum grinding wheel peripheral velocity	$TC_TPG7
AngleBevelDisc	Angle of inclined wheel	$TC_TPG8
ParamForRadiusCalculation	Parameters to calculate the radius	$TC_TPG9

*) Parameter corresponds to the system variable or the system variable is the basis for this parameter.

The following parameters are assigned to the cutting edges of the grinding tool:

Identifier/parameter	Meaning
GrindingMonitoring	Grinding-specific tool monitoring
GrindingUseBaseLength	Taking into account the basis dimension when calculating the grinding wheel radius

13.2.2.5 Magazine location parameter identifiers

For the magazine location parameters, the following identifiers are used in the configuration file:

Identifier	Parameter or property	System variable *)
MagPlaceKind	Location kind	$TC_MPP1
MagPlaceType	Location type	$TC_MPP2
MagPlaceTypeIdent	Location type as text	$TC_MPP2
MagPlaceTNo	Tool number of the tool in this location	$TC_MPP6
MagPlaceWatchNeighbour	Consider adjacent location	$TC_MPP3
MagPlaceStateLocked	Magazine location locked	$TC_MPP4, Bit0
MagPlaceStateEmpty	Magazine location free	$TC_MPP4, Bit1
MagPlaceStateResInterMag	Reserved for tool in buffer	$TC_MPP4, Bit2
MagPlaceStateResLoadTool	Reserved for tool to be loaded	$TC_MPP4, Bit3
MagPlaceStateOccupiedLeft	Magazine location occupied, left half location	$TC_MPP4, Bit4

Identifier	Parameter or property	System variable *)
MagPlaceStateOccupiedRight	Magazine location occupied, right half location	$TC_MPP4, Bit5
MagPlaceStateOccupiedUpper	Magazine location occupied, upper half location	$TC_MPP4, Bit6
MagPlaceStateOccupiedDown	Magazine location occupied, lower half location	$TC_MPP4, Bit7
MagPlaceStateReservedLeft	Magazine location reserved, left half location	$TC_MPP4, Bit8
MagPlaceStateReservedRight	Magazine location reserved, right half location	$TC_MPP4, Bit9
MagPlaceStateReservedUpper	Magazine location reserved, upper half location	$TC_MPP4, Bit10
MagPlaceStateReservedDown	Magazine location reserved, lower half location	$TC_MPP4, Bit11
MagPlaceMagazineNo	Magazine number	-
MagPlaceTypeIdx	Type index	$TC_MPP5
MagPlaceWearGroup	Wear group number	$TC_MPP5
MagPlaceAdaptNo	Adapter number	$TC_MPP7
MagPlaceNo	Magazine location number	-
MagNoMagPlaceNo	Magazine number/Magazine location number	-
MagPlaceUser_1, ... MagPlaceUser_10	OEM magazine location parameters 1 to 10	$TC_MPPC1, ... $TC_MPPC10
MagPlaceAppl_1, ... MagPlaceAppl_10	Siemens magazine location parameters 1 to 10	$TC_MPPCS1, ... $TC_MPPCS10

*) Parameter corresponds to the system variable or the system variable is the basis for this parameter.

13.2.2.6 Magazine location adapter parameter identifiers

The following identifiers are used in the configuration file for the magazine location adapter parameters:

Identifier	Parameter or property	System variable *)
MagPlaceAdapterLength1	Magazine location adapter length 1	$TC_ADPT1
MagPlaceAdapterLengthGeoAx1	Magazine location adapter geometry axis 1	$TC_ADPT1
MagPlaceAdapterLength2	Magazine location adapter length 2	$TC_ADPT2
MagPlaceAdapterLengthGeoAx3	Magazine location adapter geometry axis 3	$TC_ADPT2
MagPlaceAdapterLength3	Magazine location adapter length 3	$TC_ADPT3

Identifier	Parameter or property	System variable *)
MagPlaceAdapterLengthGeoAx2	Magazine location adapter geometry axis 2	$TC_ADPT3
MagPlaceAdapterTrafoNo	Magazine location adapter transformation number	$TC_ADPT4

*) Parameter corresponds to the system variable or the system variable is the basis for this parameter.

13.2.2.7 Multitool parameter identifiers

For the multitool parameters, the following identifiers are used in the configuration file:

Identifier	Parameter or property	System variable *)
MultiToolNo	Number of the multitool	-
MultiToolNumberOfPlaces	Number of multitool locations	$TC_MTPN
MultiToolNumberOfPlacesRO	Number of multitool locations, only read access	$TC_MTPN
MultiToolIdent	Name of the multitool	$TC_MTP2
MultiToolInMag	Magazine in which the multitool is located	$A_TOOLMN
MultiToolInPlace	Magazine location containing the multitool	$A_TOOLMLN
MultiToolInMagInPlace	Magazine number/Magazine location	$A_TOOLMN / $A_TOOLMLN
MultiToolMyMag	Owner magazine of the multitool	$A_MYMN
MultiToolMyPlace	Owner magazine location of the multitool	$A_MYMLN
MultiToolPlaceSpec	Location type	$TC_MTP7
MultiToolPlaceSpecIdent	Location type as text	$TC_MTP7
MultiToolSizeLeft	Multitool size to the left in half locations	$TC_MTP3
MultiToolSizeRight	Multitool size to the right in half locations	$TC_MTP4
MultiToolSizeUpper	Multitool size to the top in half locations	$TC_MTP5
MultiToolSizeDown	Multitool size to the bottom in half locations	$TC_MTP6
MultiToolOverSize	Multitool size as fixed setting - two half locations left, two half locations right, one half location top, one half location bottom	$TC_MTP3 - $TC_MTP6
MultiToolPosition	Multitool position	$TC_MTP_POS
MultiToolProtAreaFile	File name of the multitool description which is required to determine the protection zone	$TC_MTP_PROTA
MultiToolKindOfDist	Type of distance input of the multitool locations	$TC_MTP_KD
MultiToolKindOfDistRO	Type of distance input of the multitool locations, only read access	$TC_MTP_KD
MultiToolDistAngle	Type of distance input of the multitool locations as an angle	$TC_MTP_KD
MultiToolState	Multitool status in the hexadecimal notation	$TC_MTP8

Identifier	Parameter or property	System variable *)
MultiToolStateEnabled	Multitool status - multitool released	$TC_MTP8, Bit1
MultiToolStateLocked	Multitool status - multitool locked	$TC_MTP8, Bit2
MultiToolStateLockedRO	Multitool status - multitool locked, only read access	$TC_MTP8, Bit2
MultiToolStateInChange	Multitool status - multitool is being changed	$TC_MTP8, Bit5
MultiToolStateFixed	Multitool status - multitool fixed location coded	$TC_MTP8, Bit6
MultiToolStateUsed	Multitool status - multitool was in use	$TC_MTP8, Bit7
MultiToolStateAutoReturn	Multitool status - automatic return	$TC_MTP8, Bit8
MultiToolStateIgnoreLocked	Multitool status - do not observe locked status	$TC_MTP8, Bit9
MultiToolStateMarkedToUnload	Multitool status - multitool is selected to be unloaded	$TC_MTP8, Bit10
MultiToolStateMarkedToLoad	Multitool status - multitool is selected to be loaded	$TC_MTP8, Bit11
MultiToolStatePermanent	Multitool status - multitool is a master tool	$TC_MTP8, Bit12
MultiToolState1To1Exchange	Multitool status - one to one replacement	$TC_MTP8, Bit14
MultiToolStateHandTool	Multitool status - manual tool	$TC_MTP8, Bit15
MultiToolStateLockMtIfToolLock	Multitool status - multitool is locked if a tool is locked in multitool	$TC_MTP8, Bit16
MultiToolUser_1, ... MultiToolUser_10	OEM multitool parameters 1 to 10	$TC_MTPC1, ... $TC_MTPC10
MultiToolAppl_1, ... MultiToolAppl_10	Siemens application multitool parameters 1 to 10	$TC_MTPCS1, ... $TC_MTPCS10

*) Parameter corresponds to the system variable or the system variable is the basis for this parameter.

13.2.2.8 Multitool location parameter identifiers

For the multitool location parameters, the following identifiers are used in the configuration file:

Identifier	Parameter or property	System variable *)
MultiToolDist	Multitool location distance taking into account the actual type of distance input of the multitool	-
MultiToolDistLength	Multitool location distance, length	$TC_MTPPL
MultiToolDistAngle	Multitool location distance angle, angle	$TC_MTPPA
MultiToolPlaceType	Location type	$TC_MTPP2
MultiToolPlaceTypeIdent	Location type as text	$TC_MTPP2
MultiToolPlaceState	Multitool status in the hexadecimal notation	$TC_MTPP4
MultiToolPlaceStateLocked	Multitool location locked	$TC_MTPP4, Bit0
MultiToolPlaceStateEmpty	Multitool location empty	$TC_MTPP4, Bit1
MultiToolPlaceTNo	Tool number of the tool in this multitool location	$TC_MTPP6

Identifier	Parameter or property	System variable *)
MultiToolPlaceAdaptNo	Adapter number	$TC_MTPP7
MultiToolPlaceNo	Multitool location number	-

*) Parameter corresponds to the system variable or the system variable is the basis for this parameter.

13.2.3 Configure the list parameters

<PARAMETERCONFIGURATION> tag

In the <PARAMETERCONFIGURATION> tag, you have the following options:

1. Changing list parameters.
2. Creating new list parameters based on an existing parameter.

Changing list parameters

You can change all the parameters included in the system apart from the ISO parameters.

Tool parameter identifiers (Page 138)

Cutting parameter identifiers (Page 140)

Monitoring parameter identifiers (Page 142)

Grinding parameter identifiers (Page 143)

Magazine location parameter identifiers (Page 143)

Magazine location adapter parameter identifiers (Page 144)

Multitool parameter identifiers (Page 145)

Multitool location parameter identifiers (Page 146)

Entries	Meaning
HeadLine	Column header. Text entered is displayed as a header. Example: Text "Radius" is displayed as a header (default).
Tooltip	Text that is displayed in the tooltip. Example: Text "Geometry radius" is displayed in the tooltip (default).
ShortText	Text if the parameter is displayed in the "More Data" window. Example: Text "Rad." is displayed in the "More Data" window (default).
DetailsText	Text, if the parameter is displayed in the "Details" window. Example: Text "Radius" is displayed in the "Details" window (default).
Width	Column width in pixels in relation to a 640 x 480 resolution. See example below: The default column width is changed to 53 pixels.

Entries	Meaning	
DisplayMode	Values that the parameter is displayed with. See example below: The default setting is changed to "DoubleMode". The following values can also be accepted:	
	AnyMode	All characters
	IntegerMode	Integers
	UnsignedIntegerMode	Unsigned integers
	DoubleMode	Values with decimal places The number of decimal places is specified in "DecimalPlaces"
	UnsignedDoubleMode	Unsigned values with decimal places The number of decimal places is specified in "DecimalPlaces"
	Length	Specified length
	Angle	Specified angle
	LinearFeedPerTime	Linear feed in mm/minute
	LinearFeedPerRevolution	Linear feed in mm/revolution
	LinearFeedPerTooth	Linear feed in mm/tooth
	RevolutionSpeed	Speed
	ConstantCuttingSpeed	Constant cutting rate
DecimalPlaces	Number of decimal places if "DoubleMode" or "UnsignedDoubleMode" is selected in the DisplayMode. See example: Two decimal places are entered.	
ItemType	Field types in which a value is displayed.	
	TextField	Input/output field for values and texts
	TextFieldReadOnly	Output field for values and texts
	CheckBox	Input/output field for states
	CheckBoxReadOnly	Output field for states
BitMask	Bit mask for the display of a bit from a value. The bit mask is entered as integer value. Bit 0 → 1, Bit 1 → 2, Bit 2 → 4	
AccessLevel	Value for the access level that is used for these parameters in the user interface. Value range 1 to 7	
UpperLimit	Upper input limit for these parameters in the user interface. Only applies for numerically entered parameters.	
LowerLimit	Lower input limit for these parameters in the user interface. Only applies for numerically entered parameters.	

Example

In the following example, the `<GeoRadius>` parameter is used.

Only enter the modified data.

```
<PARAMETERCONFIGURATION>
    <GeoRadius>
        <Width value="53" type="int" />
```

```
          <DisplayMode value="DoubleMode" type="QString" />
          <DecimalPlaces value="2" type="int" />
     </GeoRadius>
</PARAMETERCONFIGURATION>
```

Configuring new list parameters based on an existing list parameter.

Assign a new parameter name and enter only the changed data:

Entries	Meaning
	Assign new parameter name See 1st example: Text `"NewGeoRadius"`
Base	Name of the parameter on which the new parameter is based. See 1st example: `"GeoRadius"` parameter is used as a template.
	Also enter only the changed data here. All other data is taken from the existing parameter. See 1st example: Column width changed to 46 pixels. Number of decimal places changed to 1.

1. Example

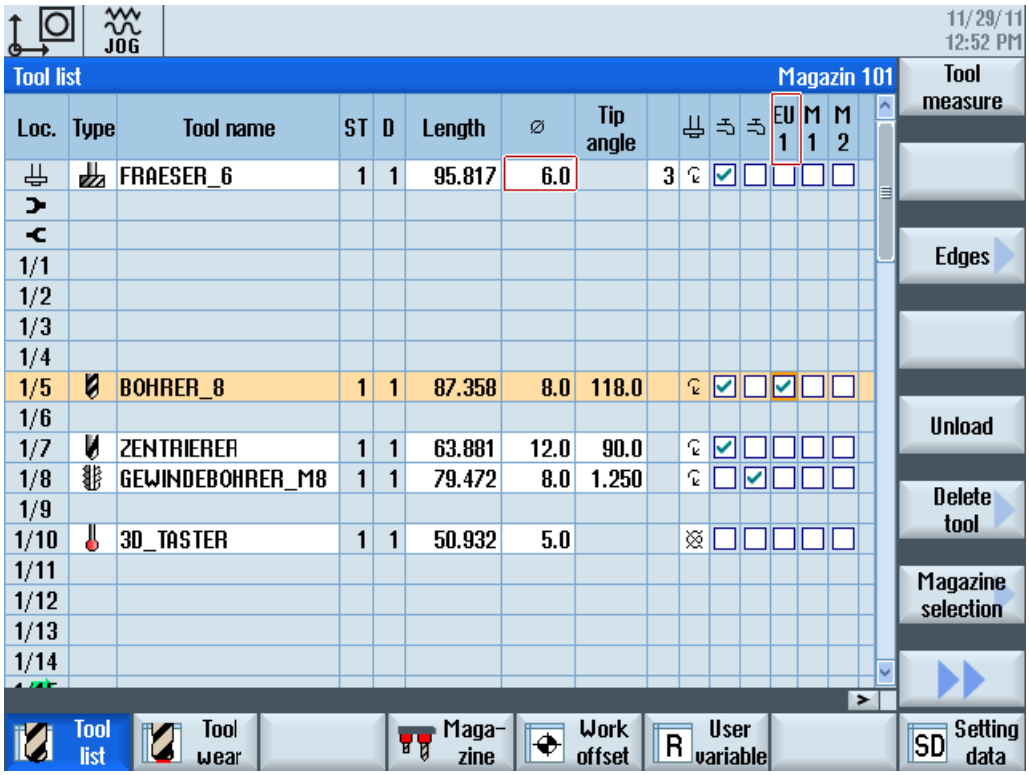
```
<PARAMETERCONFIGURATION>
     <NewGeoRadius>
          <Base value="GeoRadius" type="QString" />
          <Width value="46" type="int" />
          <DisplayMode value="DoubleMode" type="QString" />
          <DecimalPlaces value="1" type="int" />
     </NewGeoRadius>
</PARAMETERCONFIGURATION>
```

2. Example

Entries	Meaning
	Assign new cutting edge parameter name The name is `"EdgeUser_1_Bit0"` in the following example.
Base	Name of the parameter on which the new parameter is based. In the following example, the `"EdgeUser_1"` parameter is used as template.

Entries	Meaning
	Also enter only the changed data here. All other data is taken from the existing cutting edge parameter.
	The following entries are changed: Field type: Input/output field for states Value output: All characters Bit mask: Bit 0 Column width changed to 17 pixels. Header changed to "TM_HL_EDGE_USER_1_Bit0" Text in the tooltip changed to "TM_TT_EDGE_USER_1_Bit0"

```
<PARAMETERCONFIGURATION>
    <EdgeUser_1_Bit0>
        <Base value="EdgeUser_1" type="QString" />
        <ItemType value="CheckBox" type="QString" />
        <DisplayMode value="AnyMode" type="QString" />
        <BitMask value="1" type="int" />
        <Width value="17" type="int" />
        <HeadLine value="TM_HL_EDGE_USER_1_Bit0" type="QString" />
        <ToolTip value="TM_TT_EDGE_USER_1_Bit0" type="QString" />
    </EdgeUser_1_Bit0>
</PARAMETERCONFIGURATION>
```



13.2.4 List of tool types

Coding of tool types for milling tools

Group with type 1xy (milling tool):

100	Milling tool according to CLDATA (DIN 66215)
110	Ballhead cutter (cylindrical die milling tool)
111	Ballhead cutter (tapered die milling tool)
120	End mill (without corner rounding)
121	End mill (with corner rounding)
130	Angle head cutter (without corner rounding)
131	Angle head cutter (with corner rounding)
140	Facing cutter
145	Thread cutter
150	Side mill
151	Saw
155	Bevel cutter (without corner rounding)
156	Bevel cutter (with corner rounding)
157	Tapered die-sinking cutter
160	Drill and thread milling cutter

Coding of tool types for drills

Group type 2xy (drills):

200	Twist drill
205	Solid drill
210	Boring bar
220	Center drill
230	Countersink
231	Counterbore
240	Tap regular thread
241	Tap fine thread
242	Tap Whitworth thread
250	Reamer

Coding of tool types for grinding tools

Group type 4xy (grinding tools):

400	Grinding wheel circumference
410	Face grinding wheel
490	Dresser

Grinding tool types 401, 402, 403 as well as 411, 412, 413 are not listed as tool types that can be selected. The grinding-specific tool monitoring - taking into account the basis dimension when calculating the grinding wheel radius - is set using dedicated parameters. These parameters act on the tool types in the usual form.

Coding of tool types for turning tools

Group type 5xy (turning tools):

500	Roughing tool
510	Finishing tool
520	Plunge cutter
530	Parting tool
540	Threading tool
550	Steel profile
560	Rotary drill (ECOCUT)
580	Orientated probe
585	Calibration tool

Coding of tool types for special tools

Group type 7xy (special tools):

700	Slotting saw
710	3D probe
711	Edge probe
712	Mono probe
713	L probe
714	Star probe
725	Calibration tool
730	Stop
731	Spindle sleeves
732	End support
900	Auxiliary tools

13.2.5 Configure tool types

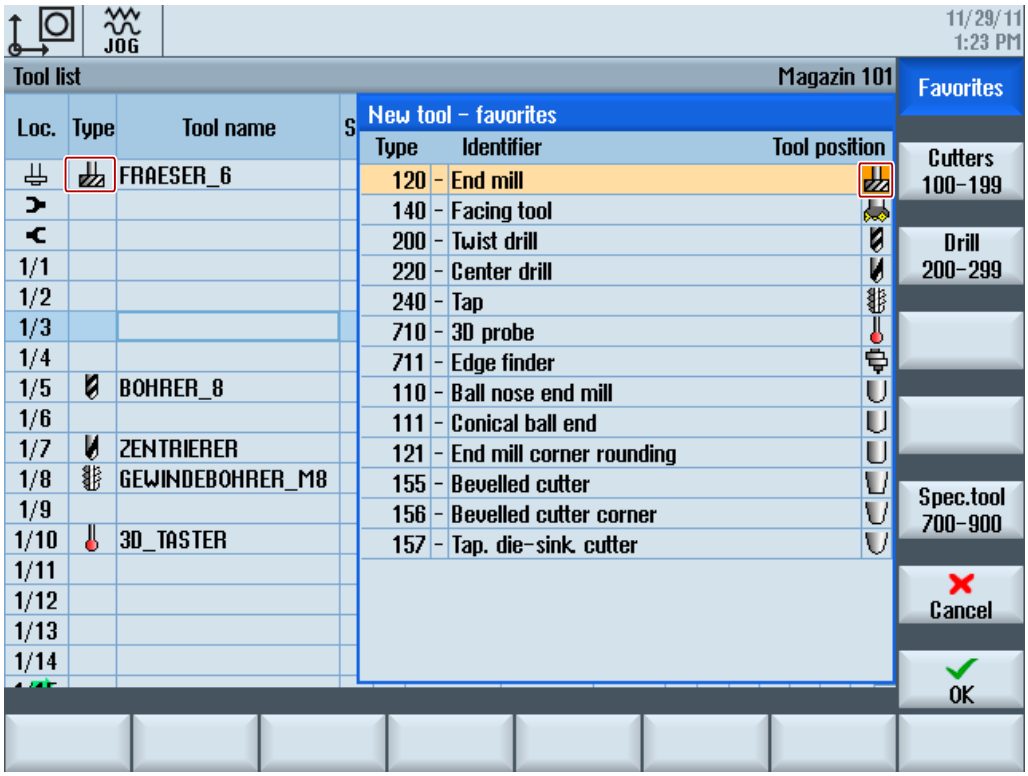
<TOOLTYPECONFIGURATION> tag

The entries used for configuring the tool types are located in the <TOOLTYPECONFIGURATION> tag:

Entries	Meaning
TOOLTYPE_XXX	XXX stands for the number of the tool type. For the assignment of the tool type and number, please refer to Section "List of tool types (Page 151)".
Tooltype	Number (XXX) of the tool type
Name	Text identifier of the tool name. The tool name is displayed in the following windows: • "New Tool - Favorites" • "New Tool - Milling Cutter 100 - 199" • "New Tool - Drill 200 - 299" • "New Tool - Special and Auxiliary Tools 700 - 900" See example: For the text identifier `"TM_PAR_SHANK_END_CUTTER"`, the name "End mill" appears on the user interface.
Shortname	Text identifier of the tool name. Tool name is displayed in the tool list. See example: For the text identifier `"TM_PPTT_SHANK_END_CUTTER"`, the name "MILLING CUTTER" appears on the user interface.
Tooltip	Text identifier of the tool name. This tool name is displayed in the tooltip. See example: For the text identifier `"TM_TTTT_SHANK_END_CUTTER"`, the name "End mill" appears on the user interface.
Icon9 - for milling technology	Icon representing the tool type. The icons are displayed in the following windows: • "Tool List" in the "Type" column • "New Tool - Favorites" in the "Tool position" column • "New Tool - Milling Cutter 100 - 199" in the "Tool position" column • "New Tool - Milling Cutter 200 - 299" in the "Tool position" column • "New Tool - Special Tool 700 - 900 in the "Tool position" column. The icons are in ".png" format. They are stored according to image resolution in the following directories: /**oem**/sinumerik/hmi/ico/ico640, or ico800, or ico1024 /**user**/sinumerik/hmi/ico/ico640, or ico800, or ico1024
IconX - for turning technology	Icon representing the tool type (see Icon9 - for milling technology) Special feature - tool positions are supported in turning technology. X is for the tool position represented by the icon. Position 9 is an undefined position represented by a cross.
Iconorder	Order in which the tool positions, represented by icons, are switched.

Example

```
<TOOLTYPECONFIGURATION>
     <TOOLTYPE_120>
       <Tooltype value="120" type="uint" />
       <Name value="TM_PAR_SHANK_END_CUTTER" type="QString" />
       <Shortname value="TM_PPTT_SHANK_END_CUTTER" type="QString" />
       <Tooltip value="TM_TTTT_SHANK_END_CUTTER" type="QString" />
       <Icon9 value="to_poly_shank_end_cutter_down.png" type="QString" />
     </TOOLTYPE_120>
</TOOLTYPECONFIGURATION>
```



13.2.6 Configuring the "More data" window

<MOREDATACONFIGURATION> tag

The entries used for configuring the "Additional Data" window are located in the <MOREDATACONFIGURATION> tag. Various data items can be displayed for each tool type in a number of rows and columns. Each data item to be displayed is specified by entering a list parameter:

Tool parameter identifiers (Page 138)

Cutting parameter identifiers (Page 140)

Monitoring parameter identifiers (Page 142)

A brief description of the parameter then appears (ShortText), with the value itself beside it. Configure the list parameters (Page 147).

If another description text is required in the "More Data" window, a text can also be entered in a row or column. In the window, the width of the text is made to conform to that of the brief description and value of a parameter.

Any number of rows and columns can be created. A scrollbar appears when the window reaches a certain size.

Entries	Meaning
TOOLTYPE_XXX	Number of the tool type. See example: Tool type 111 = Ball end mill (tapered die-sinking cutter).
ROWX_COLY	Particular rowX_columnY. If there is no entry after rowX and columnY, this field remains blank. See example: In the "More Data" window, the first row is blank.
Item	The following entries are possible: • Parameter identifier • Text See example: The header "Corner radius" appears in the second row of the window. The text "Radius" and an input field for the value appear in the third row of the window. The fourth row is blank.

Example

```
<MOREDATACONFIGURATION>
     <TOOLTYPE_111>
         <ROW1_COL1>
         </ROW1_COL1>
         <ROW2_COL1>
             <Item value="TM_DGL_CORNER_RADIUS" type="QString" />
         </ROW2_COL1>
         <ROW3_COL1>
             <Item value="GeoCornerRadius" type="QString" />
         </ROW3_COL1>
         <ROW4_COL2>
         </ROW4_COL2>
     </TOOLTYPE_111>
</MOREDATACONFIGURATION>
```

13.2.7 Configure the "New tool - favorites" window

<NEWTOOLFAVORITECONFIGURATION> tag

In the tag <NEWTOOLFAVORITECONFIGURATION> you define the tool types that are most frequently used. The specified tool types are displayed in the "New Tool - Favorites" window.

Entries	Meaning
StaticTooltypes	Numbers of tool types Enter the individual numbers, separated by blanks. The following section describes the assignment of the tool type and number: List of tool types (Page 151)

Example

```
<NEWTOOLFAVORITECONFIGURATION>
     <StaticTooltypes value="120 140 200 220 710 711" type="QString"/>
</NEWTOOLFAVORITECONFIGURATION>
```

13.2.8 Configuring the "New Tool" window

<NEWTOOLCONFIGURATION> tag

You use the "New Tool" dialog to supply a new tool with specific tool data before creating the tool or before loading the tool to a magazine location. These are typically the tool size and/or the tool location type because these parameters can no longer be changed when the tool is loaded. It is also useful to display the tool types and the tool names in this window.

Specify the parameters in the <NEWTOOLCONFIGURATION> tag that are to be displayed in the "New Tool" dialog. The number of parameters is limited by the size of the window.

Entries	Meaning
ItemX	Entry of the identifier of the tool parameter. "X" specifies the order in which the parameters are displayed in the window. The identifier of the tool parameter can be found in Section Tool parameter identifiers (Page 138)

Example

```
<NEWTOOLCONFIGURATION>
     <Item1 value="ToolTypeToggle" type="QString"/>
     <Item2 value="ToolIdent" type="QString"/>
     <Item3 value="ToolSizeLeft" type="QString"/>
     <Item4 value="ToolSizeRight" type="QString"/>
</NEWTOOLCONFIGURATION>
```

13.2.9 Configuring default values for new tools

<NEWTOOLDEFAULTVALUECONFIGURATION> tag

In the <NEWTOOLDEFAULTVALUECONFIGURATION> tag, you can specify default values for tools that you create via the user interface. These values can be configured depending on the tool type and, if required, also depending on the cutting edge position:

Entries	Meaning
TOOLTYPE_ALL	The parameter setting applies to all tool types.
TOOLTYPE_XXX	The parameter setting applies to a specific tool type. XXX stands for the number of the tool type.
CUTTEDGEPOS_XXX	The parameter setting applies to a specific cutting edge position. XXX stands for the number of the cutting edge position.
Default	Default value of the parameter.

Example

```
<NEWTOOLDEFAULTVALUECONFIGURATION>
    <!-- Initialize geometry length 1 for all tool types to 70.0 -->
    <TOOLTYPE_ALL>
        <GeoLengthGeoAx1>
            <Default value="70.0" type="double" />
        </GeoLengthGeoAx1>
    </TOOLTYPE_ALL>
    <!-- Initialize tip angle of the twist drill to 120.0 -->
    <TOOLTYPE_200>
        <NoseAngle>
            <Default value="120.0" type="double" />
        </NoseAngle>
    </TOOLTYPE_200>
    <TOOLTYPE_500>
        <!-- Initialize plate angle of the roughing tool to 82.0 -->
            <PlateAngle>
                <Default value="82.0" type="double" />
            </PlateAngle>
        <!-- Initialize holder angle of the roughing tool depending on the cutting edge
        position -->
        <HolderAngle>
                <CUTTEDGEPOS_1>
                    <Default value="93.0" type="double" />
                </CUTTEDGEPOS_1>
                <CUTTEDGEPOS_2>
                    <Default value="93.0" type="double" />
                </CUTTEDGEPOS_2>
                <CUTTEDGEPOS_3>
                    <Default value="93.0" type="double" />
```

```
                </CUTTEDGEPOS_3>
                <CUTTEDGEPOS_4>
                    <Default value="93.0" type="double" />
                </CUTTEDGEPOS_4>
                <CUTTEDGEPOS_5>
                    <Default value="49.0" type="double" />
                </CUTTEDGEPOS_5>
                <CUTTEDGEPOS_6>
                    <Default value="49.0" type="double" />
                </CUTTEDGEPOS_6>
                <CUTTEDGEPOS_7>
                    <Default value="49.0" type="double" />
                </CUTTEDGEPOS_7>
                <CUTTEDGEPOS_8>
                    <Default value="49.0" type="double" />
                </CUTTEDGEPOS_8>
            </HolderAngle>
        </TOOLTYPE_500>
        <!-- Initialize coolant 2 of the plunge cutter to switched on -->
        <TOOLTYPE_520>
            <Coolant2>
                <Default value="true" type="bool" />
            </Coolant2>
        </TOOLTYPE_520>
</NEWTOOLDEFAULTVALUECONFIGURATION>
```

Default values when creating new tools

System variables		Default value
Tool size		
Size on left	$TC_TP3	1
Size on right	$TC_TP4	1
Size above	$TC_TP5	1
Size below	$TC_TP6	1
Magazine location type of the tool		
Created outside of the magazine	$TC_TP7	1
Created in a magazine location	$TC_TP7	Location type of the magazine location
Tool status		
released	$TC_TP8	2

The following combinations between the cutting-edge position and the cutting direction result dependent on the tool type. When creating the new tool, the operator selects a combination in the "New Tool - Favorites" window.

Tool type $TC_DP1	Default values	
	Cutting edge $TC_DP2	Cutting direction $TC_DP11
Type 500 roughing tool	1	4
Type 510 finishing tool	2	3
Type 560 rotary drill	3	3
	4	4
	5	1
	6	3
	7	1
	8	3
Type 520 plunge cutter	1	2
Type 530 cut-off tool	1	4
Grinding tool types	4	4
	3	1
	4	1
	2	3
	3	3
	2	2
Type 540 threading tool	5	2
	5	1
	8	3
	8	4
	6	3
	6	4
	7	2
	7	1

If the ShopMill/ShopTurn option is set, the **direction of spindle rotation** is preassigned:

Tool type $TC_DP1	Default value $TC_DP25	Direction of spindle rotation
Measuring tools		
Type 580/585/710/712/713/725	Bit 8 = 0 Bit 9 = 0	Spindle stop
Turning tools dependent on SD54215 TM_FUNCTION_MASK_SET bit 1		
SD54215 bit 1 = 0	Bit 8 = 1 Bit 9 = 0	Spindle right
SD54215 bit 1 = 1	Bit 8 = 0 Bit 9 = 1	Spindle left

Tool type $TC_DP1	Default value $TC_DP25	Direction of spindle rotation
Special tools		
Type 730/731/732	Bit 8 = 0 Bit 9 = 0	Spindle stop
All other tool types		
-	Bit 8 = 1 Bit 9 = 0	Spindle right

Tool type $TC_DP1	Default value $TC_DP25 for switching direction
Type 712 mono probe	Bit 17 = 1 Bit 20 = 1
Type 713 L probe	Bit 17 = 1 Bit 21 = 1
Type 714 star probe	Bit 16 = 1 Bit 17 = 1 Bit 18 = 1 Bit 19 = 1

Tool type $TC_DP1	Default value $TC_DP24 for tip angle
Type 200 twist drill	118
Type 220 centering tool	90

The plate angle rather than the clearance angle is displayed on the screen:
plate angle = 180 - holder angle - clearance angle

Tool type $TC_DP1	Default values		
	Cutting edge position $TC_DP2	Holder angle $TC_DP10	Clearance angle $TC_DP24
Type 500 roughing tool	1 to 4	95	5
	5 to 8	50	50
Type 510 finishing tool	1 to 4	93	32
	5 to 8	62.5	62.5
Type 560 rotary drill	-	90	2

Tool type $TC_DP1	Unit of measurement	Default value $TC_DP8 for plate length
Type 500 roughing tool	metric	11
Type 510 finishing tool	inch	0.4

For all grinding tools, the parameter for **calculating the radius**:
$TC_TPG9 = 3 (corresponds to length 1) applies

13.2.10 Configuring the "Details" window

<DETAILSCONFIGURATION> tag

In the tag <DETAILSCONFIGURATION> you can make the settings at the "Detail" window:

Entries	Meaning
ShowToolNumber	The tool number is displayed in the upper right field of the "Detail" window.
UseAxisNameInLength	The tool lengths are displayed with axis identifiers, e.g. length X instead of length 1. If no data is specified, then the setting is taken from the tool lists.
ShowBaseLength	The basis length is displayed in the "Detail" window (AdaptLength1, AdaptLength2 and AdaptLength3). If no data is specified, then the setting is taken from the tool lists.
ShowYAxis	The Y axis is displayed in the "Detail" window. If no data is specified, then the setting is taken from the tool lists.

Example

```
<DETAILSCONFIGURATION>
    <ShowToolNumber value="true" type="bool" />
</DETAILSCONFIGURATION>
```

13.2.11 Assigning a name for magazines and magazine locations

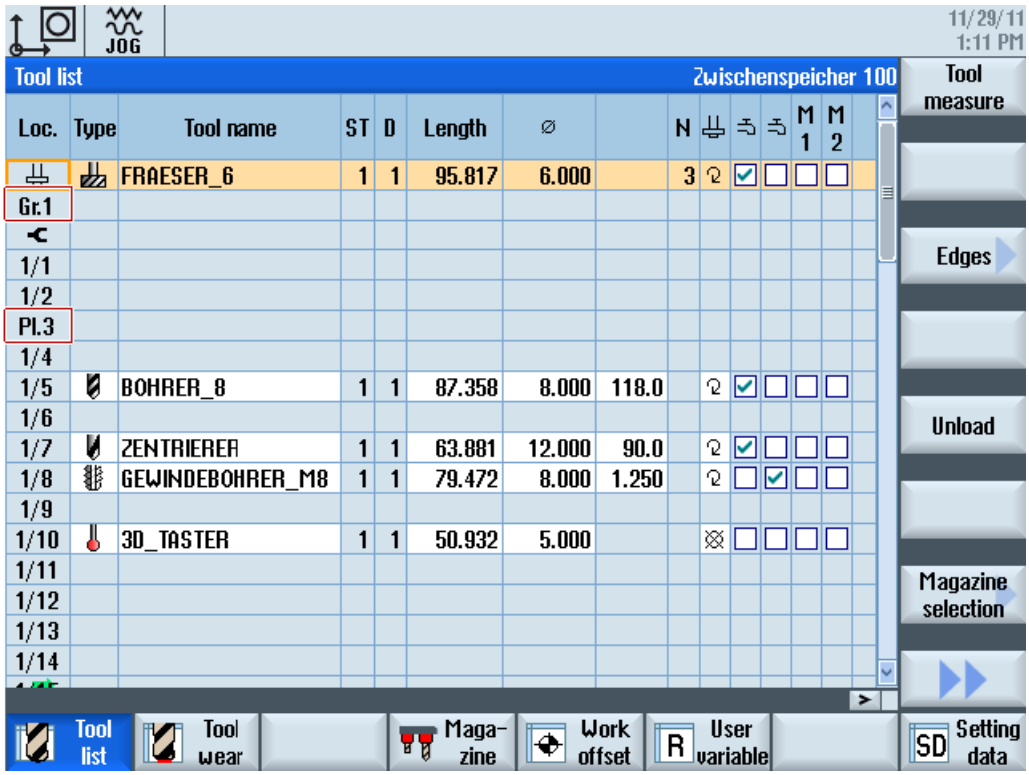
<MAGAZINEPLACENAMECONFIGURATION> tag

The entries to assign dedicated magazine location names are located in the <MAGAZINEPLACENAMECONFIGURATION> tag. Magazine locations can be displayed with texts. Instead of the identifier, e.g. 1/5 for the first magazine, location five, the configured text is then output in the tool lists.

Entries	Meaning
MAGAZINE_XXX	XXX stands for the magazine number.
PLACE_XXX	XXX stands for the location number.
Name	Text identifier of the magazine location.

Example

```
<MAGAZINEPLACENAMECONFIGURATION>
    <MAGAZINE_9998>
        <PLACE_2>
            <Name value="TM_SPECIAL_MAG_PLACE_1" type="QString" />
        </PLACE_2>
    </MAGAZINE_9998>
    <MAGAZINE_1>
        <PLACE_3>
            <Name value="TM_SPECIAL_MAG_PLACE_2" type="QString" />
        </PLACE_3>
    </MAGAZINE_1>
</MAGAZINEPLACENAMECONFIGURATION>
```



Name for a magazine

Dedicated texts can also be allocated for magazines. The text or the text identifier is entered into the magazine configuration file (ini file) of the NC. The system variable for the magazine name is $TC_MAP2[magNo]. The magazine name is displayed at the top right in the tool lists.

Example

Magazine 1 should have the name "main magazine".

```
$TC_MAP2[1]="main magazine"
```

If the "main magazine" text is to be output language-dependent, then the language-dependent texts for the text identifier "main magazine" must be created.

See also

Please refer to the following section for the procedure to create language-dependent text:

Creating OEM texts (Page 172)

13.2.12 Assigning a name for magazine location types

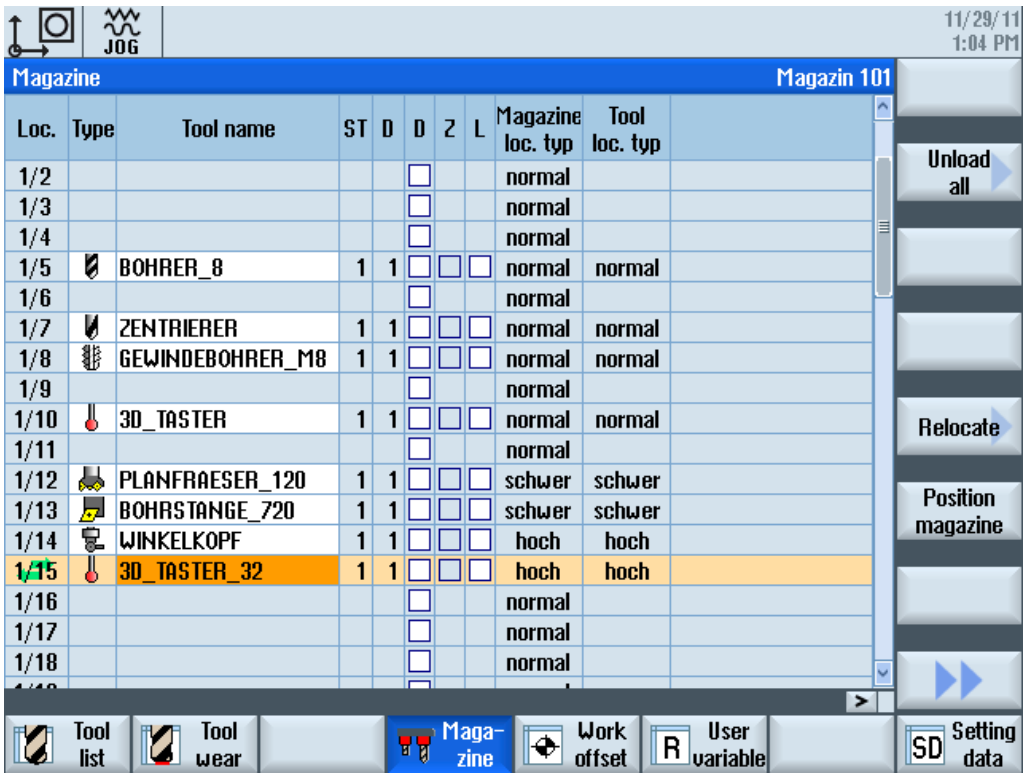
<PLACETYPECONFIGURATION> tag

You can find entries to allocate your own location type identifiers in the tag <PLACETYPECONFIGURATION>. Magazines and magazine location types can be displayed with texts in the tool lists. Instead of identifier 2, e.g. for location type 2, the configured text is then output in the tool lists.

Entries	Meaning
PLACETYPEXXX	XXX stands for the number of the location type
Text	Text identifier of the location type
Tooltip	Tooltip text identifier of the location type

Example

```
<PLACETYPECONFIGURATION>
     <PLACETYPE1>
        <Text value="TM_PLACETYPE_1" type="QString" />
        <Tooltip value="TM_TT_PLACETYPE_1" type="QString" />
     </PLACETYPE1>
     <PLACETYPE2>
        <Text value="TM_PLACETYPE_2" type="QString" />
        <Tooltip value="TM_TT_PLACETYPE_2" type="QString" />
     </PLACETYPE2>
     <PLACETYPE3>
        <Text value="TM_PLACETYPE_3" type="QString" />
        <Tooltip value="TM_TT_PLACETYPE_3" type="QString" />
     </PLACETYPE3>
</PLACETYPECONFIGURATION>
```



See also

Please refer to the following section for the procedure to create language-dependent text:

Creating OEM texts (Page 172)

13.2.13 Assignment of magazines to channels

Requirement

Turning technology has been set: Name of the associated configuration file sltmturninglistconfig.xml.

Assignment between magazine and channel

With this setting, magazines can be assigned to channels. This makes sense if the machine is configured so that several channels are assigned to one tool area (TOA area). If each magazine is then only used in one channel, here it is possible to specify this assignment between the magazine and channel.

As a consequence of this configuration, the tool icons are output with reference to their position depending on the channel. Every channel can be assigned a position using the channel machine data MD52000 MCS_DISP_COORDINATE_SYSTEM. If a tool is at a magazine location which is assigned a channel via this configuration, then the tool icon is output depending on this position that has been set.

This setting option is only available for turning. This can be especially helpful if, on a multi-channel machine, a magazine is used before the turning center and another magazine after the turning center. This means that the tools can be entered into the tool list in a position visible for the operator.

<CHANNELMAGAZINEASSIGNMENT> tag

Entries to assign magazines to channels are in the <CHANNELMAGAZINEASSIGNMENT> tag.

Entries	Meaning
CHANNELNO_XXX	XXX stands for the channel number.
MAGAZINES	Number of the magazines that are assigned to the channel.

Example

The following assignment between magazine and channel should apply:

Magazine 1-3	Channel 1
Magazine 4	Channel 2
Magazine 5	Channel 3
Magazine 6	Channel 4

```
<CHANNELMAGAZINEASSIGNMENT>
   <CHANNELNO_1>
      <Magazines value="1 2 3" type="QString" />
   </CHANNELNO_1>
   <CHANNELNO_2>
      <Magazines value="4" type="QString" />
   </CHANNELNO_2>
   <CHANNELNO_3>
      <Magazines value="5" type="QString" />
   </CHANNELNO_3>
   <CHANNELNO_4>
      <Magazines value="6" type="QString" />
   </CHANNELNO_4>
</CHANNELMAGAZINEASSIGNMENT>
```

13.2.14 Coolant and tool-specific functions

Assigning coolant (ShopMill/ShopTurn)

In the tool management of ShopMill/ShopTurn, you can assign coolant and tool-specific functions to each tool. These are activated when the tool is changed. You assign the coolant to the corresponding machine functions (M functions) using the following machine data:

MD52230 $MCS_M_CODE_ALL_COOLANTS_OFF	M code for all coolants OFF
MD52231 $MCS_M_CODE_COOLANT_1_ON	M code for coolant 1 ON
MD52232 $MCS_M_CODE_COOLANT_2_ON	M code for coolant 2 ON
MD52233 $MCS_M_CODE_COOLANT_1_AND_2_ON	M code for both coolants ON

Tool-specific functions (ShopMill)

Tool-specific functions 1 ... 4 are intended for other M functions that can be activated for a tool, for example, third coolant, speed monitoring, tool breakage, etc.

Up to eight M functions can be programmed for the activation or deactivation of the tool-specific functions. Definition is realized using the following machine data:

MD52281 $MCS_TOOL_MCODE_FUNC_ON[0...3]	M code for tool-specific function ON
= - 1	

MD52282 $MCS_TOOL_MCODE_FUNC_OFF[0...3]	M code for tool-specific function OFF
= - 1	

The M functions for the tool-specific functions are executed by the ShopMill cycles at the tool change. If the checkbox is activated, the corresponding M code is generated from MD52281. If the checkbox is not activated, the corresponding M code is generated from MD52282.

If you do not want to automatically execute additional M commands at the tool change, then set the associated machine data to -1 for the M commands of this tool-specific function. This also hides the associated fields in the tool list.

The default value of the machine data is -1 so that no M values are output for the corresponding functions.

Technical procedure

The M functions for the tool-specific functions are generated by the ShopMill cycles in a set (up to four M commands are possible).

The number and also the sequence of the M commands are dependent on the settings of the machine data (MD52281 to MD52282) and the programming.

If M functions less than 100 are used, the number and sequence of the M commands has no significance. They are located in the user PLC in the decoded area (DB21.DBB194 to DB21.DBB206), independent of the number and the sequence when programming.

However, if M functions from 100 and higher are used, then you must decode these yourself in the user PLC. In this case, you must take into consideration the number and sequence (M function 1 to M function 4).

JOG mode

In the JOG mode, no coolant and tool-specific functions are output to the interface. For a tool change in the JOG mode, these functions can be initiated by the operator using the keys on the machine control panel (implementation via the PLC user program).

Example: Machine data settings

MD52281 $MCS_TOOL_MCODE_FUNC_ON[0]	= 90
MD52281 $MCS_TOOL_MCODE_FUNC_ON[1]	= 92
MD52281 $MCS_TOOL_MCODE_FUNC_ON[2]	= 94
MD52281 $MCS_TOOL_MCODE_FUNC_ON[3]	= 96

MD52282 $MCS_TOOL_MCODE_FUNC_OFF[0]	= 91
MD52282 $MCS_TOOL_MCODE_FUNC_OFF[1]	= - 1
MD52282 $MCS_TOOL_MCODE_FUNC_OFF[2]	= 95
MD52282 $MCS_TOOL_MCODE_FUNC_OFF[3]	= 97

As a result, fields 1 to 4 of the tool-specific functions are displayed in the tool list.

The following fields are activated:

Tool-specific function 1:	On
Tool-specific function 2:	Off
Tool-specific function 3:	Off
Tool-specific function 4:	Off

The M functions M90, M95 and M97 are generated by the ShopMill cycles at the tool change.

You can change the texts for "Coolant 1/2 on/off" and "Tool-spec. fct. 1, ..." (see Section Identifiers of the standard texts (Page 173)). So that the texts between the tool list and program area machine functions match, please note the following section.

Creating user-specific texts for the "Machine Functions" window.

If you require an additional possibility of switching on or switching off coolant and tool-specific functions, then you can program this in the "Program" operating area using the input window "Machine Functions". You can create the texts and the tooltips for the tool-specific functions which are used in this window.

Define the texts for the M functions in the file "slstepforms_xxx.ts".

If you require the texts in additional languages, then you must create a separate file for each language. The names of the files only differ by the language code "xxx" (Supported languages (Page 513)). Use only the specified language codes.

File "slstepforms_xxx.ts "

Tag	Meaning
source	Text identifier for label: SlStepLabels A maximum of up to four M functions can be defined: T_LAB_USER_MACHINE_FUNC_1 T_LAB_USER_MACHINE_FUNC_2 T_LAB_USER_MACHINE_FUNC_3 T_LAB_USER_MACHINE_FUNC_4
	Text identifier for tooltip: SlStepToolTip There are 3 tooltips for every machine function x (1 - 4): T_TT_USER_MACHINE_FUNC_x: Standard tooltip if the machine function was not selected. T_TT_USER_MACHINE_FUNC_x _ON: Tooltip when the machine function is activated T_TT_USER_MACHINE_FUNC_x_OFF: Tooltip for deactivated machine function
translation	Text, which is displayed at the user interface. Label texts: You can only enter texts on one line. The "lines" entry is not applicable. Tooltip: You can enter multi-line texts. A line break is set using the "%n" character.
chars	Text length The maximum text length is 30 characters.
lines	Number of lines The maximum number of lines is three.
remark	Own comment - entry is not displayed at the user interface.

Procedure

1. You can copy the sample file "oem_slstepforms_deu.ts" from the following directory: /**siemens**/sinumerik/hmi/template/lng
2. Save or create the file in the /**oem**/sinumerik/hmi/lng or /**user**/sinumerik/hmi/lng directory.
3. Change the file name to "slstepforms_deu.ts".

   If you require texts for additional languages, then a separate file must be created for each language. Save the file with the appropriate language code in the file name.
4. Open the file and define the texts in the <message> and </message> areas.
5. Restart the system.

   The file must still be converted into a binary format in order that the texts are displayed during the program runtime. This data is only converted during power up.

Example of a file "slstepforms_deu.ts"

```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE TS><TS>
<context>
   <name>SlStepLabels</name>
   <message>
      <source>T_LAB_USER_MACHINE_FUNC_1</source>
      <translation>tool-specific function 1</translation>
      <chars>20</chars>
   </message>
<context>
   <name>SlStepToolTip</name>
   <!-- tooltips of user machine function 1-->
   <message>
      <source>T_TT_USER_MACHINE_FUNC_1</source>
      <translation>User%nMachine functions 1</translation>
      <chars>25</chars>
      <lines>3</lines>
   </message>
</context
</TS>
```

13.2.15 Reason for the tool change when reactivating

Requirement

Software option

You require the "MC Information System TDI Statistic" option for this function

Function

When reactivating a tool, you have the option of specifying the reason for the tool change, e.g. to use this information for statistical purposes. The "Reason for Tool Change" selection window is opened after pressing the "Reactivate" softkey. In a checkbox, you can select the reason for the tool change.

Tool change reasons

You can adapt or expand the tool change reasons as required. The operating software provides the following pre-defined texts for the configuration:

Text identifier	Text
TM_DGL_DESIRED_PIECES_ELAPSED	Unit quantity setpoint (desired pieces) elapsed
TM_DGL_TOOL_BREAKAGE	Tool breakage
TM_DGL_CUTTING_EDGE_DAMAGE	Cutting edge damage
TM_DGL_PREMATURE_WEAR	Premature wear
TM_DGL_TYPE_REEQUIPPING	Type reequipping
TM_DGL_TOOL_TRIAL	Tool trial
TM_DGL_PREVENTIVE_CHANGE	Preventive change

<TOOLCHANGEREASON> tag

You configure the function in the <TOOLCHANGEREASON> tag:

Parameter		Designation
Enable	true	The "Reason for Tool Change" selection window is displayed when reactivating.
	false	Default value, selection window is not displayed.
REASONXXX		XXX stands for an internal number. The numbers for the tool change reason must be clear and unique.
Text		Text identifier of the tool change reason.
Parameter		Parameter identifier of the parameter in which it is entered whether the tool change reason was selected.

Example

The following example uses the texts for the tool change reason, already prepared in the operating software. In this example, the tool change reason is stored in parameters that still have to be configured, e.g. the OEM tool data 1, bit 1 and following.

```
<TOOLCHANGEREASON>
   <Enabled value="true" type="bool" />
     <REASON1>
       <Text value="TM_DGL_DESIRED_PIECES_ELAPSED" type="QString" />
       <Parameter value="ToolUser_1_Bit1" type="QString" />
     </REASON1>
     <REASON2>
       <Text value="TM_DGL_TOOL_BREAKAGE" type="QString" />
       <Parameter value="ToolUser_1_Bit2" type="QString" />
     </REASON2>
     <REASON3>
```

```
      <Text value="TM_DGL_CUTTING_EDGE_DAMAGE" type="QString" />
      <Parameter value="ToolUser_1_Bit3" type="QString" />
    </REASON3>
    <REASON4>
      <Text value="TM_DGL_PREMATURE_WEAR" type="QString" />
      <Parameter value="ToolUser_1_Bit4" type="QString" />
    </REASON4>
    <REASON5>
      <Text value="TM_DGL_TYPE_REEQUIPPING" type="QString" />
      <Parameter value="ToolUser_1_Bit5" type="QString" />
    </REASON5>
    <REASON6>
      <Text value="TM_DGL_TOOL_TRIAL" type="QString" />
      <Parameter value="ToolUser_1_Bit6" type="QString" />
    </REASON6>
    <REASON7>
      <Text value="TM_DGL_PREVENTIVE_CHANGE" type="QString" />
      <Parameter value="ToolUser_1_Bit7" type="QString" />
    </REASON7>
</TOOLCHANGEREASON>
```

See also

For configuring new parameters, see Configure the list parameters (Page 147) .

13.3 Creating OEM texts

Overview

This section describes how you create OEM texts in a particular language.

The texts are created in the "sltmlistdialog_xxx.ts" file.

A dedicated file must be created for each language. The file names differ by the language code (Supported languages (Page 513)). For "xxx", set the appropriate language code.

Creating texts

All OEM texts from the previous sections, such as the tooltip, can be made language-dependent by using the OEM text as text identifier under the "source" tag. The translation of the text in the particular language is entered under the "translation" tag.

Entries	Meaning
source	Text identifier See 1st example: Single-line text with new text identifier "MY_NEW_TEXT". See 2nd example: Double-line text with new text identifier "MY_NEW_TEXT_2_LINES".
translation	Text, which is displayed on the user interface. You can enter single and multi-line texts. "%n" is used to indicate a line break. See 1st example: Single-line text "My new text" is displayed. See 2nd example: Double-line text "My new - text" is displayed.
chars	Text length See 1st example: Text length of 30 characters is specified. See 2nd example: Text length of 10 characters per line is specified.
lines	Number of lines See 2nd example: The number of rows is 2.
remark	Own comments - are not displayed.

Procedure

1. You can copy the sample file "oem_sltmlistdialog_eng.ts" from the following directory: /**siemens**/sinumerik/hmi/template/lng
2. Save the file in the /**oem**/sinumerik/hmi/lng or /**user**/sinumerik/hmi/lng directory.
3. Change the file name to "sltmlistdialog_eng.ts".
   If you wish to create texts for additional languages, then a separate file must be created for each language. Save the file with the appropriate language code in the file name.
4. Open the file and define the texts in the <message> and </message> areas.
5. Restart the system.

   The file must still be converted into a binary format in order that the texts are displayed during the program runtime. This data is only converted during power up.

13.3.1 Identifiers of the standard texts

Identifiers of the standard texts

With the help of the identifiers, you can change the standard texts of OEM parameters, coolants and tool-specific functions. This applies to the column header in the tool lists, the tooltip and, if available, also the designation in the detail displays.

A list of the identifiers is provided below:

Identifiers of OEM tool parameters

"ToolUser_1" to "ToolUser_10"

"ToolAppl_1" to "ToolAppl_10"

Column heading	Tooltip
TM_HL_TOOL_USER_1 to ...10	TM_TT_TOOL_USER_1 to ...10
TM_HL_TOOL_APPL_1 to ...10	TM_TT_TOOL_APPL_1 to ...10

Tool details	Tool details - all parameters
TM_HL_TOOL_USER_1_DETAILS to ...10_DETAILS	TM_HL_TOOL_USER_1_LONG to ...10_LONG
TM_HL_TOOL_APPL_1_DETAILS to ...10_DETAILS	TM_HL_TOOL_APPL_1_LONG to ...10_LONG

Identifiers of the OEM cutting edge parameters

"EdgeUser_1" to "EdgeUser_10"

"EdgeAppl_1" to "EdgeAppl_10"

Column heading	Tooltip
TM_HL_EDGE_USER_1 to ...10	TM_TT_EDGE_USER_1 to ...10
TM_HL_EDGE_APPL_1 to ...10	TM_TT_EDGE_APPL_1 to ...10

Tool details	Tool details - all parameters
TM_HL_EDGE_USER_1_DETAILS to ...10_DETAILS	TM_HL_EDGE_USER_1_LONG to ...10_LONG
TM_HL_EDGE_APPL_1_DETAILS to ...10_DETAILS	TM_HL_EDGE_APPL_1_LONG to ...10_LONG

Identifiers of the OEM monitoring parameters

"EdgeSupUser_1" to "EdgeSupUser_10"

"EdgeSupAppl_1" to "EdgeSupAppl_10"

Column heading	Tooltip
TM_HL_EDGE_SUPUSER_1 to ...10	TM_TT_EDGE_SUPUSER_1 to ...10
TM_HL_EDGE_SUPAPPL_1 to ...10	TM_TT_EDGE_SUPAPPL_1 to ...10

Tool details	Tool details - all parameters
TM_HL_EDGE_SUPUSER_1_DETAILS to ...10_DETAILS	TM_HL_EDGE_SUPUSER_1_LONG to ...10_LONG
TM_HL_EDGE_SUPAPPL_1_DETAILS to ...10_DETAILS	TM_HL_EDGE_SUPAPPL_1_LONG to ...10_LONG

Identifiers of OEM multitool parameters

"MultiToolUser_1" to "MultiToolUser_10"

"MultiToolAppl_1" to "MultiToolAppl_10"

Column heading	Tooltip
TM_HL_MULTITOOL_USER_1 to ...10	TM_TT_MULTITOOL_USER_1 to ...10
TM_HL_MULTITOOL_APPL_1 to ...10	TM_TT_MULTITOOL_APPL_1 to ...10

Tool details	Tool details - all parameters
TM_HL_MULTITOOL_USER_1_DETAILS to ...10_DETAILS	TM_HL_MULTITOOL_USER_1_LONG to ...10_LONG
TM_HL_MULTITOOL_APPL_1_DETAILS to ...10_DETAILS	TM_HL_MULTITOOL_APPL_1_LONG to ...10_LONG

Identifiers of the OEM magazine location parameters

"MagPlaceUser_1" to "MagPlaceUser_10"

"MagPlaceAppl_1" to "MagPlaceAppl_10"

Column heading	Tooltip
TM_HL_MAGPLACE_USER_1 to ...10	TM_TT_MAGPLACE_USER_1 to ...10
TM_HL_MAGPLACE_APPL_1 to ...10	TM_TT_MAGPLACE_APPL_1 to ...10

Identifiers of OEM multitool location parameters

"MtPlaceUser_1" to "MtPlaceUser_10"

"MtPlaceAppl_1" to "MtPlaceAppl_10"

Column heading	Tooltip
TM_HL_MTPLACE_USER_1 to ...10	TM_TT_MTPLACE_USER_1 to ...10
TM_HL_MTPLACE_APPL_1 to ...10	TM_TT_MTPLACE_APPL_1 to ...10

Identifiers of the coolant and tool-specific functions

"Coolant1" and "Coolant2"

"MFunction1" to "MFunction4"

Column heading	Tooltip
No column	TM_TT_STATE_COOL_1 and ...2
TM_HL_MFCT1 to ...4	TM_TT_MFCT1 to ...4

13.3.2 Examples of OEM texts

Example 1 with a single-line and double-line text

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE TS><TS>
<!--      ********************************************************** -->
<!--      Definition of OEM texts
<!--      ********************************************************** -->
<context>
   <name>SlTmListForm</name>
<!--      ********************************************************** -->
<!--      enter your text behind this comment -->
<!--      ********************************************************** -->
<!--      ********************************************************** -->
<!--      1st example of a single-line text -->
<!--      ********************************************************** -->
<!--   <message>
         <source>MY_NEW_TEXT</source>
         <translation>My new text</translation>
         <chars>30</chars>
       </message>-->
<!--      ********************************************************** -->
<!--      2nd example of a double-spaced text -->
<!--      ********************************************************** -->
<!--   <message>
         <source>MY_NEW_TEXT_2_LINES</source>
         <translation>My new%n text</translation>
         <remark>My comment to the text</remark>
         <chars>10</chars>
         <lines>2</lines>
       </message>-->
```

```
<!--      ********************************************************** -->
<!--      enter your text ahead of this comment -->
<!--      ********************************************************** -->
</context>
</TS>
```

Example 2

A new parameter is configured in the following example from Section Configure the list parameters (Page 147):

```
<PARAMETERCONFIGURATION>
    <EdgeUser_1_Bit0>
        <Base value="EdgeUser_1" type="QString" />
        <ItemType value="CheckBox" type="QString" />
        <DisplayMode value="AnyMode" type="QString" />
        <BitMask value="1" type="int" />
        <Width value="17" type="int" />
        <HeadLine value="TM_HL_EDGE_USER_1_Bit0" type="QString" />
        <ToolTip value="TM_TT_EDGE_USER_1_Bit0" type="QString" />
    </EdgeUser_1_Bit0>
</PARAMETERCONFIGURATION>
```

The two texts under HeadLine and ToolTip should be output depending on the language. To do this, the two text identifiers must be included in the sltmlistdialog_xxx.ts file:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE TS><TS>
<!--      ********************************************************** -->
<!--      Definition of OEM texts
<!--      ********************************************************** -->
<context>
   <name>SlTmListForm</name>
<!--      ********************************************************** -->
<!--      enter your text behind this comment -->
<!--      ********************************************************** -->
<!--      ********************************************************** -->
<!--      Translate the text for the headline -->
<!--      ********************************************************** -->
      <message>
        <source>TM_HL_EDGE_USER_1_Bit0</source>
        <translation>heavy %n tool</translation>
        <chars>10</chars>
        <lines>2</lines>
      </message>
<!--      ********************************************************** -->
<!--      Translate the text for the tooltip -->
<!--      ********************************************************** -->
```

```
      <message>
        <source>TM_TT_EDGE_USER_1_Bit0</source>
        <translation>heavy tool</translation>
        <chars>20</chars>
      </message>
<!--  ********************************************************* -->
<!--  enter your text ahead of this comment -->
<!--  ********************************************************* -->
</context>
</TS>
```

13.4 Examples

13.4.1 Example: Configuring an OEM tool list

13.4.1.1 Adapting the configuration file

The following excerpt shows the contents of the configuration file:

- Milling technology: sltmlistconfig.xml
- Turning technology: sltmturninglistconfig.xml

The file in this example is stored in the "user/sinumerik/hmi/cfg" directory.

This example describes a configuration of the OEM tool list.

- OEM tool parameter 1 is displayed in column 6.
- A new "Coolant 3" parameter is inserted in column 7 that displays bit 0 from OEM tool parameter 2.
- OEM cutting edge parameter 1 is displayed in column 8.

Example

"sltmlistconfig.xml" or "sltmturninglistconfig.xml" file:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<CONFIGURATION>
  <!-- **** Identifier for the configuration of the lists *** -->
  <LISTCONFIGURATION>
    <!-- **** OEM tool list *** -->
    <SlTmTooloemForm>
      <!-- **** Enabling the OEM tool list *** -->
      <Enabled value="true" type="bool" />
```

```
    <!-- **** Columns 1 to 5 have already been assigned default values. *** -->
    <!-- **** Column 6 *** -->
    <COLUMN6>
      <!-- **** For all tool types *** -->
      <TOOLTYPE_ALL>
        <!-- **** Display OEM tool parameter 1 *** -->
        <Item value="ToolUser_1" type="QString" />
      </TOOLTYPE_ALL>
    </COLUMN6>
    <!-- **** Column 7 *** -->
    <COLUMN7>
      <!-- **** For all tool types *** -->
      <TOOLTYPE_ALL>
        <!-- **** Priority tool, own parameter *** -->
        <!-- **** Display OEM tool parameter 2 bit 0 *** -->
        <Item value="PriorTool" type="QString" />
      </TOOLTYPE_ALL>
    </COLUMN7>
    <!-- **** Column 8 *** -->
    <COLUMN8>
      <!-- **** For all tool types *** -->
      <TOOLTYPE_ALL>
        <!-- **** Display OEM cutting edge parameter 1 *** -->
        <Item value="EdgeUser_1" type="QString" />
      </TOOLTYPE_ALL>
    </COLUMN8>
  </SlTmTooloemForm>
</LISTCONFIGURATION>
<!-- **** Identifier for the configuration of own parameter *** -->
<PARAMETERCONFIGURATION>
  <!-- **** Change OEM tool parameter 1 *** -->
  <ToolUser_1>
    <!-- **** Column width *** -->
    <Width value="36" type="int" />
    <!-- **** Type change to unsigned integer *** -->
    <DisplayMode value="UnsignedIntegerMode" type="QString" />
  </ToolUser_1>
  <!-- **** Identifier of own parameter *** -->
  <!-- **** Priority tool *** -->
  <PriorTool>
    <!-- ** New parameter is based on OEM tool parameter 2**-->
    <Base value="ToolUser_2" type="QString" />
    <!-- **** Bit 0 is evaluated *** -->
    <BitMask value="1" type="int" />
    <!-- **** Text identifier of the headline *** -->
    <HeadLine value="TMO_HL_PRIOR_TOOL" type="QString" />
    <!-- **** Text identifier of the tooltip *** -->
```

```
      <ToolTip value="TMO_TT_PRIOR_TOOL" type="QString" />
      <!-- **** Column width *** -->
      <!-- **** Recommended widths 640x480 - 19 pixels *** -->
      <!-- **** 800x600 - 21, 1024x768 - 17 *** -->
      <Width value="19" type="int" />
      <!-- **** Display item of the parameter *** -->
      <ItemType value="CheckBox" type="QString" />
    </PriorTool>
  </PARAMETERCONFIGURATION>
</CONFIGURATION>
```

13.4.1.2 Adaptation of the customer text file

The following excerpt shows the contents of the "sltmlistdialog_eng.ts" customer text file.

The file in this example is stored in the "user/sinumerik/hmi/lng" directory.

Example

"sltmlistdialog_eng.ts" file:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE TS><TS>

<!-- ************************************************************ -->
<!-- Definition of OEM texts -->
<!-- ************************************************************ -->
<context>
     <name>SlTmListForm</name>

<!-- ************************************************************ -->
<!-- Enter your text behind this comment -->
<!-- ************************************************************ -->

      <!-- **** OEM tool parameter 1 headline *** -->
      <!-- **** Weight *** -->
      <message>
        <!-- **** Text identifier *** -->
        <source>TM_HL_TOOL_USER_1</source>
        <!-- **** Text that is output *** -->
        <translation>%nweight</translation>
        <!-- **** Comment only for the translator *** -->
        <remark>priority tool</remark>
        <!-- **** Maximum line length in characters *** -->
        <!-- **** only for the translator *** -->
        <chars>7</chars>
```

```
    <!-- **** Number of possible lines *** -->
    <!-- **** only for the translator *** -->
    <lines>2</lines>
  </message>
  <!-- **** OEM tool parameter 1 tooltip *** -->
  <!-- **** Weight *** -->
  <message>
    <source>TM_TT_TOOL_USER_1</source>
    <translation>weight of the tool</translation>
    <chars>35</chars>
    <lines>2</lines>
  </message>
  <!-- **** Headline for own parameter *** -->
  <!-- **** Priority tool *** -->
  <message>
    <source>TMO_HL_PRIOR_TOOL</source>
    <translation>V</translation>
    <remark>priority tool</remark>
    <chars>1</chars>
    <lines>2</lines>
  </message>
  <!-- **** Tooltip for own parameter *** -->
  <!-- **** Priority tool *** -->
  <message>
    <source>TMO_TT_PRIOR_TOOL</source>
    <translation>priority tool, %nuse tool preferably< /translation>
    <chars>35</chars>
    <lines>3</lines>
  </message>
  <!-- **** OEM cutting edge parameter 1 headline *** -->
  <!-- **** Maximum tool width *** -->
  <message>
    <source>TM_HL_EDGE_USER_1</source>
    <translation>maximum%nwidth</translation>
    <chars>8</chars>
    <lines>2</lines>
  </message>
  <!-- **** OEM cutting edge parameter 1 tooltip *** -->
  <!-- **** Maximum tool width *** -->
  <message>
    <source>TM_TT_EDGE_USER_1</source>
    <translation>maximum width%nof the tool%noverall</translation>
    <chars>35</chars>
    <lines>2</lines>
  </message>

<!-- ************************************************************ -->
<!-- Enter your text ahead of this comment -->
```

```
<!-- ************************************************************ -->

</context>
</TS>
```

13.4.2 Example: Configuring magazine location types with names

13.4.2.1 Adapting the configuration file

The following excerpt shows the contents of the configuration file:

- Milling technology: sltmlistconfig.xml
- Turning technology: sltmturninglistconfig.xml

The file in this example is stored in the "user/sinumerik/hmi/cfg" directory.

This example describes a configuration of the location types in the magazine list.

In this example, the magazine location type and the tool location type are to be displayed as a toggle field with plain texts.

The assignment of the parameters to the columns of the list is made in the "LISTCONFIGURATION" area. The magazine location type is displayed in column 10. The tool location type is displayed in column 11.

The texts to the location types are assigned in the "PLACETYPECONFIGURATION" area. The number of the location type is the number at the end of the "PLACETYPE" identifier. A text identifier for a toggle box entry and a text identifier for a tooltip can be stored for each location type.

Example

"sltmlistconfig.xml" or "sltmturninglistconfig.xml" file:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<CONFIGURATION>
   <!-- **** Configuration of the lists *** -->
   <LISTCONFIGURATION>
     <!-- **** Magazine list *** -->
     <SlTmToolmagazinForm>
       <!-- **** Column 10 *** -->
       <COLUMN10>
         <!-- **** For all tool types *** -->
         <TOOLTYPE_ALL>
           <!-- **** Display magazine location type *** -->
           <Item value="MagPlaceTypeIdent" type="QString" />
         </TOOLTYPE_ALL>
       </COLUMN10>
       <!-- **** Column 11 *** -->
```

```
        <COLUMN11>
          <!-- **** For all tool types *** -->
          <TOOLTYPE_ALL>
            <!-- **** Display tool location type *** -->
            <Item value="ToolPlaceSpecIdent" type="QString" />
          </TOOLTYPE_ALL>
          <!-- **** For all multitools *** -->
          <TOOLTYPE_9997>
            <!-- **** Display for all multitool location types *** -->
            <Item value="MultiToolPlaceSpecIdent" type="QString" />
          </TOOLTYPE_9997>
        </COLUMN11>
      </SlTmToolmagazinForm>
    </LISTCONFIGURATION>
    <!-- **** Configuration of the magazine location types *** -->
    <PLACETYPECONFIGURATION>
      <!-- **** Magazine location type 1 *** -->
      <PLACETYPE1>
        <!-- **** Text identifier of the toggle box entry *** -->
        <Text value="TMMP_ITEM_NORMAL_TOOL" type="QString" />
        <!-- **** Text identifier of the tooltip *** -->
        <Tooltip value="TMMP_TT_NORMAL_TOOL" type="QString" />
      </PLACETYPE1>
      <!-- **** Magazine location type 2 *** -->
      <PLACETYPE2>
        <Text value="TMMP_ITEM_HEAVY_TOOL" type="QString" />
        <Tooltip value="TMMP_TT_HEAVY_TOOL" type="QString" />
      </PLACETYPE2>
      <!-- **** Magazine location type 3 *** -->
      <PLACETYPE3>
        <Text value="TMMP_ITEM_BIG_TOOL" type="QString" />
        <Tooltip value="TMMP_TT_BIG_TOOL" type="QString" />
      </PLACETYPE3>
      <!-- **** Magazine location type 4 *** -->
      <PLACETYPE4>
        <Text value="TMMP_ITEM_SENSITIVE_TOOL" type="QString" />
        <Tooltip value="TMMP_TT_SENSITIVE_TOOL" type="QString" />
      </PLACETYPE4>
    </PLACETYPECONFIGURATION>
</CONFIGURATION>
```

13.4.2.2 Adaptation of the customer text file

The following excerpt shows the contents of the "sltmlistdialog_eng.ts" customer text file.

The file in this example is stored in the "user/sinumerik/hmi/lng" directory.

Example

"sltmlistdialog_eng.ts" file:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE TS><TS>

<!-- ************************************************************ -->
<!-- Definition of OEM texts -->
<!-- ************************************************************ -->
<context>
     <name>SlTmListForm</name>

<!-- ************************************************************ -->
<!-- Enter your text behind this comment -->
<!-- ************************************************************ -->
     <!-- **** Magazine location type 1 item *** -->
     <!--  **** Normal tool *** -->
     <message>
       <!-- **** Text identifier *** -->
       <source>TMMP_ITEM_NORMAL_TOOL</source>
       <!-- **** Text that is output *** -->
       <translation>normal</translation>
       <!-- **** Maximum line length in characters *** -->
       <!-- **** only for the translator *** -->
       <chars>9</chars>
     </message>
     <!-- **** Magazine location type 1 tooltip *** -->
     <!-- **** Normal tool *** -->
     <message>
       <source>TMMP_TT_NORMAL_TOOL</source>
       <translation>normal tool,%nno restrictions</translation>
       <chars>35</chars>
       <lines>2</lines>
     </message>
     <!-- **** Magazine location type 2 item *** -->
     <!-- **** Heavy tool *** -->
     <message>
       <source>TMMP_ITEM_HEAVY_TOOL</source>
       <translation>heavy</translation>
       <chars>9</chars>
     </message>
```

```
<!-- **** Magazine location type 2 tooltip *** -->
<!-- **** Heavy tool *** -->
<message>
  <source>TMMP_TT_HEAVY_TOOL</source>
  <translation>heavy tool</translation>
  <chars>35</chars>
  <lines>2</lines>
</message>
<!-- **** Magazine location type 3 item *** -->
<!-- **** Big tool *** -->
<message>
  <source>TMMP_TT_BIG_TOOL</source>
  <translation>big</translation>
  <chars>9</chars>
</message>
<!-- **** Magazine location type 3 tooltip *** -->
<!-- **** Big tool *** -->
<message>
  <source>TMMP_TT_BIG_TOOL</source>
  <translation>big tool</translation>
  <chars>35</chars>
  <lines>2</lines>
</message>
<!-- **** Magazine location type 4 item *** -->
<!-- **** Sensitive tool *** -->
<message>
  <source>TMMP_ITEM_SENSITIVE_TOOL</source>
  <translation>sensitive</translation>
  <chars>9</chars>
</message>
<!-- **** Magazine location type 4 tooltip *** -->
<!-- **** Sensitive tool *** -->
<message>
  <source>TMMP_TT_SENSITIVE_TOOL</source>
  <translation>Notice: Tool can%nbe destroyed easily</translation>
  <chars>35</chars>
  <lines>2</lines>
</message>

<!-- ************************************************************ -->
<!-- Enter your text ahead of this comment -->
<!-- ************************************************************ -->

</context>
</TS>
```

Configuring alarms

14

14.1 Creating alarm and message texts via the user interface

From the user interface, you can create and edit your alarm and message texts from the part program. In turn, the alarm and message texts are saved corresponding to their number in various text files.

File

Text file	Alarms	Number ranges	Color	PopUp
oem_alarms_plc	User PLC alarm texts	500 000 to 899 999	Black/red (selectable)	Additional text display yes/no
oem_alarms_cycles	User cycle alarm texts	60 000 to 69 999	Black/red (selectable)	Additional text display yes/no
oem_partprogram_messages	User message texts from the part program	1 to 999 999	Green (specified)	Additional text display yes/no

An overview of the alarm and number ranges is provided in Section Range of alarms (Page 204).

Storage

The text files are created in the directory:
/**oem**/sinumerik/hmi/lng

Procedure

1. Select the "Start-up" operating area.

2. Press the "HMI" softkey.

3. Press the "Alarm texts" softkey.
   The "Select File" window opens and offers the user-specific text files.

4. Select the desired file and press the "OK" softkey.
   The window, e.g. "Edit Alarm Texts (User PLC Alarm Texts) German" opens.
5. Enter the desired alarm number in the "Number" column.
   Enter the desired alarm text in the "Alarm text" column.
   Select the desired font color in the "Color" column.
   In the column "PopUp" with "yes" or "no", select whether the alarm text should be displayed in a window that requires acknowledgment - or not.
   - AND / OR -

   Press the "Insert line" softkey.
   A new line is inserted above your cursor.
   - OR

   Press the "Delete line" softkey to delete the selected line.

6. Press the "Search" softkey.
   The "Search" window appears.
   Enter the desired alarm text or the alarm number in the "Text" field.
   Activate the "Case sensitive" checkbox if a distinction must be made between upper- and lower-case letters when entering text.
   - OR

   Press the "Search and replace" softkey.
   The "Search and Replace" window appears.
   Enter the search term in the "Text" field. Enter the replacing term in the "Replace with" field.

7. Position the cursor in the "Direction" field. Using the <SELECT> key, select the search direction (forwards, backwards).

8. Press the "OK" softkey to start search or search and replace.

   Press the "Cancel" softkey if you wish to interrupt the action.

9. If you have entered the alarms with the help texts, press the "OK" softkey.
   You will receive the message "The alarm texts have been saved and converted."

Restart SINUMERIK Operate

You must restart SINUMERIK Operate in order that the "color" and "PopUp" attributes take effect. Modified alarm texts, however, take effect immediately.

Further search options

The cursor jumps to the first entry of the selected alarm text file.

The cursor jumps to the last entry of the selected alarm text file.

Foreign language alarm and message texts

If you create foreign language alarm and message texts, change over into the desired language. All text files are automatically allocated the language code corresponding to the user interface language that has been selected. For instance, if you create alarm texts in the English user interface, then the text file is assigned the "eng" language code.

14.2 Configuring alarm and message texts via alarm text files

You have the option of creating customized alarm and message texts using alarm text files and adapting these.

The alarm texts are set up in standard format (".ts" format) by SINUMERIK Operate. The ".ts" format is XML-based.

You can create and edit these files not only with SINUMERIK Operate, but also externally on a PC.

Note

If you wish to edit alarm text files on a PC, use an editor supporting UTF-8 coding.

Creating and editing alarm texts

- Creating your own alarm texts
- Creating texts for indexed alarm parameters
- Creating part program message texts
- Changing alarm attributes
- Replacing standard alarm texts
- Converting alarm texts

14.2.1 Creating in-house alarm texts

Creating an alarm text file

1. You can copy a sample file "oem_alarms_eng.ts" from the following directory: /**siemens**/sinumerik/hmi/template/lng
2. Save or create the file in the /**oem**/sinumerik/hmi/lng or /**user**/sinumerik/hmi/lng directory. Create a separate file for each country language that is supported.
3. Assign a unique name to the file, e.g. "my_alarms_eng.ts". You can freely select the file names with the exception of the language code and the extension.
   The file name always ends with the language code of the particular language and always has the ".ts" extension. For example "my_alarms_deu.ts" for German or "my_alarms_eng.ts" for English.

Creating alarm texts

1. Open the "my_alarms_eng.ts" file.
2. For each alarm text, you must insert your own area in the file that is marked using the <message> tag.
3. The <name> tag contains the context names. Normally, you should not change the specified name "`slaeconv`".
4. The <source> tag contains the alarm number and the name of the alarm source (source URL). In the example "700000" is the alarm number and "/PLC/PMC" is the name of the alarm source. The possible alarm sources can be found in the tables in Section Range of alarms (Page 204).
5. The <translation> tag contains the alarm text.

Example:

```
<!DOCTYPE TS>
<TS>
     <context>
         <name>slaeconv</name>
         <message>
               <source>700000/PLC/PMC</source>
               <translation>First OEM alarm text</translation>
         </message>
         <message>
               <source>700001/PLC/PMC</source>
               <translation>Second OEM alarm text</translation>
         </message>
     </context>
</TS>
```

Registering the alarm text file

You still have to register your alarm text file so that the system knows your alarm texts during the program runtime:

1. You can copy a sample configuration file "oem_slaesvcadapconf.xml" from the following directory: /**siemens**/sinumerik/hmi/template/cfg
2. Save the file in the directory /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg
3. Assign the name "slaesvcadapconf.xml" to the file.
4. Open the file and in the <BaseNames> tag, enter the file name of the alarm text file without language code and file extension, e.g. "my_alarms", as "value".
   The registration of your alarm text file starts, for example, with the name "OEM_BaseName_01".

NOTICE
The names of the <BaseNames> tag can be freely selected. They must be unique in the system and must not clash with names used by Siemens. The "Siemens_BaseName_01" name is reserved for Siemens.

   Several alarm text files can also be registered. To do this, use names such as "OEM_BaseName_02", "OEM_BaseName_03", etc.

Example:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<!-- Configuration of the Solutionline Alarm & Event Service Adapter -->
<CONFIGURATION>
     <AlarmTexts>
          <BaseNames>
               <OEM_BaseName_01 type="QString" value="my_alarms"/>
          </BaseNames>
     </AlarmTexts>
     ...
</CONFIGURATION>
```

Restart SINUMERIK Operate

The files must still be converted into a binary format so that the alarm texts can be displayed during the program runtime. This data is only converted during power up.

To do this, restart SINUMERIK Operate. In the same directory where the .ts files are located, files with the same name are created with the ".qm" file extension.

The result of the conversion is written to the "alarmtext_conversion.log" or "oem_text_conversion.log" file. Errors that occur during the conversion, such as syntax errors in a parameter file, are also written to the file.

This file is located in the "/user/sinumerik/hmi/log" directory.

Note

The conversion is only made if the .ts file is newer than the associated .qm file.

14.2.2 Creating texts for indexed alarm parameters

If a string, the so-called "Index identifier", is specified in the alarm text in pointed brackets after a space holder (e.g. "%1<OEM>"), the parameter itself is not inserted in the alarm text, but a text from another alarm text file, a so-called index text file. In this case, the alarm parameter value serves as index in order to select the text in the index file. The index text can, in turn, include parameters, also index parameters.

Note

Explanation for the "Index identifier" string

- "<" ≙ opening pointed bracket "<"
- ">" ≙ closing pointed bracket ">"

Creating an index text file

1. You can copy a sample index text file "oem_indexparams_eng.ts" from the following directory: /**siemens**/sinumerik/hmi/template/lng
2. Save or create the file in the /**oem**/sinumerik/hmi/lng or /**user**/sinumerik/hmi/lng directory. Create a separate file for each country language that is supported.
3. Assign a unique name to the file, e.g. "my_indextexts_eng.ts". You can freely select the file names with the exception of the language code and the extension.

   The file name always ends with the language code of the particular language and always has the ".ts" extension. For instance, "my_indextexts_deu.ts" for German or "my_indextexts_eng.ts" for English.

Creating index texts

1. Open the "my_indextexts_eng.ts" file.
2. In the <name> tag, enter a name that you have selected, e.g. "my_context".
3. For each index text, a separate area must be inserted between the <message> and </message> tags.
4. The <source> tag contains the alarm parameter value, e.g. the values "1" and "2".
5. The <translation> tag includes the index text that is displayed if the alarm parameter involved has the value specified between <source> and </source>.

Example

```
<!DOCTYPE TS>
<TS>
      <context>
          <name>my_context</name>
          <message>
                <source>1</source>
                <translation>First OEM parameter text</translation
          </message>
          <message>
                <source>2</source>
                <translation>Second OEM parameter text</translation
          </message>
      </context>
</TS>
```

Registering an index text file

You still have to register your index text file so that the system knows your index texts during the program runtime. The registration is made in the "slaesvcadapconf.xml" file.

1. Open the file "slaesvcadapconf.xml" already created for the alarm texts /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg directory.
2. Remove the lines "<!-- Start of comment" and "End of comment -->".
3. Enter the so-called identifier, e.g. <Identifier type="QString" value="OEM"/>. The index identifier is always specified in pointed brackets next to the parameter specification in the alarm text, e.g. "%1<OEM>".
4. Enter the BaseName of the index text file, e.g.
   <BaseName type="QString" value="my_indextexts"/>.
5. Enter the context name that you selected, e.g.
   <ContextName type="QString" value="my_context"/>.
6. You can also use several different indices. Then, in this case, a dedicated section must be created for every index between the <IndexTexts> and </IndexTexts> tags. The tags for these sections are called, e.g.
   <OEM_IndexText_01>, <OEM_IndexText_02>, <OEM_IndexText_03>, etc.
   The tags <IndexText_01> to <IndexText_99> are reserved for Siemens.

Example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<!- Configuration of the Solutionline Alarm & Event Service Adapter ->
<CONFIGURATION>
...
```

```
        <!-- The following narrated part of the configuration is used only when
        'Indexparameters' (e.g. '%1&lt;OEM&gt;') are used within OEM alarm texts. In
        this case the value of the parameter is used as an index into an additional text
        list to reference another text which is placed into the alarm text instead of
        the original parameter value. -->
        <IndexTexts>

            <OEM_IndexText_01>

                <Identifier type="QString" value="OEM"/>
                <BaseName type="QString" value="my_indextexts"/>
                <ContextName type="QString" value="my_context"/>
                <MetaTextID type="QString" value="%ParamValue%"/>
            </OEM_IndexText_01>

        </IndexTexts>

</CONFIGURATION>
```

Restart SINUMERIK Operate

The files must still be converted into a binary format so that the alarm texts can be displayed during the program runtime. This data is only converted during power up.

To do this, restart SINUMERIK Operate. In the same directory where the .ts files are located, files with the same name are created with the ".qm" file extension.

The result of the conversion is written to the "alarmtext_conversion.log" or "oem_text_conversion.log" file. Errors that occur during the conversion, such as syntax errors in a parameter file, are also written to the file.

This file is saved in the /user/sinumerik/hmi/log directory.

Note

The conversion is only made if the .ts file is newer than the associated .qm file.

14.2.3 Creating part program message texts

Message texts from the part program

In order to output message texts from the part program, use the MSG instruction in the part program. The message texts are referenced via the number after the "$ character, e.g. MSG("$4711"). You can configure channel-specific message texts for each NC channel.

Creating message texts

Procedure:

1. You can copy a sample message text file "oem_pp_messages_eng.ts" from the following directory: /**siemens**/sinumerik/hmi/template/lng
2. Save or create the file in the /**oem**/sinumerik/hmi/lng or /**user**/sinumerik/hmi/lng directory. Create a separate file for each country language that is supported.

3. Assign a unique name to the file, e.g. "my_msgs_eng.ts". You can freely select the file names with the exception of the language code and the extension.
   The file name always ends with the language code of the particular language and always has the ".ts" extension. For instance, "my_msgs_deu.ts" for German or "my_msgs_eng.ts" for English.
4. Open the "oem_msgs_eng.ts" file and in the <name> tag enter the "partprogmsg01" character string. This is the default for the part program message texts from all channels.
5. For each message text, a separate area must be inserted between the <message> and </message> tags.
6. The <source> tag contains the number from the MSG command in the part program.
7. The <translation> tag contains the message text.

Example

```
<!DOCTYPE TS>
<TS>
   <context>
     <name>partprogmsg01</name>
     <message>
         <source>4711</source>
         <translation>part program message No. 4711</translation
     </message>
   </context>
</TS>
```

Registering the message text file

You still have to declare your message text file so that the system knows your message texts during the program runtime.

1. You can copy a sample configuration file "oem_slaesvcadapconf.xml" from the following directory: /**siemens**/sinumerik/hmi/template/cfg
2. Save or create the file in the /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg directory.

3. Change the name to "slaesvcadapconf.xml".
4. Open the file and in the <BaseNames> tag enter the file name of the message text file without language code and file extension, e.g. "my_msgs", as "value". The registration of your message text file starts, for example, with the name "OEM_BaseName_01".

NOTICE
The names of the <BaseNames> tag can be freely selected. They must be unique in the system and must not clash with names used by Siemens. The "Siemens_BaseName_01" name is reserved for Siemens.

Several message text files can also be registered. To do this, use names such as "OEM_BaseName_02", "OEM_BaseName_03", etc.

Example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<!-- Configuration of the Solutionline Alarm & Event Service Adapter -->
<CONFIGURATION>
     <AlarmTexts>
         <BaseNames>
             <OEM_BaseName_01 type="QString" value="my_msgs"/>
         </BaseNames>
     </AlarmTexts>
     ...
</CONFIGURATION>
```

Message texts for several channels

It is possible to assign different message texts the same message number, e.g. the number 4711 in different NC channels. This means, different message texts are output depending on the channel in which the part program is executed.

1. Open the "oem_msgs_eng.ts" file in the editor.
2. Change the text between the two <name> and </name> tags from "partprogmsg01" into "partprogmsgXY", whereby "XY" should be replaced by the particular channel number, e.g. "partprogmsg02" for channel 2.
3. Now open the "slaesvcconf.xml" configuration file.
4. Enter the respective NC channel in the <Connections> tag. Only use the XML tags from the following table to specify the NC channel.

NC channel	XML tag	ContextName
1	PartprogramMessageChannel_01	partprogmsg01
2	PartprogramMessageChannel_02	partprogmsg02
3	PartprogramMessageChannel_03	partprogmsg03

NC channel	XML tag	ContextName
4	PartprogramMessageChannel_04	partprogmsg04
5	PartprogramMessageChannel_05	partprogmsg05
6	PartprogramMessageChannel_06	partprogmsg06
7	PartprogramMessageChannel_07	partprogmsg07
8	PartprogramMessageChannel_08	partprogmsg08
9	PartprogramMessageChannel_09	partprogmsg09
10	PartprogramMessageChannel_10	Partprogmsg10

Example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<!-- Configuration of the Solutionline Alarm & Event Service Adapter -->
<CONFIGURATION>
     <Connections>

         <PartprogramMessageChannel_02>

             <ContextName type="QString" value="partprogmsg02"/>

         </PartprogramMessageChannel_02>

     </Connections>

</CONFIGURATION>
```

Restart SINUMERIK Operate

The files must still be converted into a binary format so that the alarm texts can be displayed during the program runtime. This data is only converted during power up.

To do this, restart SINUMERIK Operate. In the same directory where the .ts files are located, files with the same name are created with the ".qm" file extension.

The result of the conversion is written to the "alarmtext_conversion.log" or "oem_text_conversion.log" file. Errors that occur during the conversion, such as syntax errors in a parameter file, are also written to the file.

This file is saved in the /user/sinumerik/hmi/log directory.

Note

The conversion is only made if the .ts file is newer than the associated .qm file.

14.2.4 Changing alarm attributes

Color types of the alarms

You can individually change the colors of the alarms and messages displayed in the message line.

You can change the following for each alarm number and alarm source:

- Font color of the alarm/message text
- Background color of the alarm/message text
- Font color of the alarm number
- Background color of the alarm number

Create alarm attribute file

Procedure:

1. You can copy a sample alarm attribute file "oem_slaedatabase.xml" from the directory: /**siemens**/sinumerik/hmi/template/cfg/
2. Save the file in the directory /**oem**/sinumerik/hmi/cfg/ or /**user**/sinumerik/hmi/cfg/
3. Assign a unique name to the file, e.g. " muster_slaedatabase.xml ".
   The file name can be freely selected; however, it must only contain lower-case letters.

Defining alarm colors

Procedure:

1. Open the file "muster_slaedatabase.xml" in the editor.
2. First, enter which alarm colors you generally wish to change.
   To do this, create a separate section <Attribute> for each alarm color that you wish to change in the <Attributes> area.
3. Enter the attribute name of the alarm color to be changed in the <Attribute AttrName=…> tag. You can change the following colors:
   - Font color of the alarm/message text = TEXTCOLOR
   - Background color of the alarm/message text = TEXTBACKGROUNDCOLOR
   - Font color of the alarm number = NUMBERCOLOR
   - Background color of the alarm number = NUMBERBACKGROUNDCOLOR
4. Alarm sources are defined in the <Sources> area for whose alarms the alarm colors are to be changed, e.g. the alarm sources "/HMI" and "/PLC/PMC".

Note

If you insert further alarm sources, make sure that the alarm number is always assigned to the correct alarm source.

The possible values for source ID and URL can be found in the table in Section Range of alarms (Page 204).

5. In the <Alarms> tag, create a separate sub-area for each alarm or for an alarm number range.
6. Enter the alarm number in the <Alarm AlarmID= "..." > tag, or enter the alarm number range in the <Range FromAlarmID="..." ToAlarmID= "..."> tag.
7. Enter the required color values in the following tags:
   <TEXTCOLOR>
   <TEXTBACKGROUNDCOLOR>
   <NUMBERCOLOR>
   <NUMBERBACKCOLOR>
   The attributes of the color values are defined by specifying an RGB value:
   - An RGB value always starts with the "#" character.
   - The individual color values R, G and B are represented by double-digit hexadecimal numbers. Syntax: "#RRGGBB", e.g. "#FF9A00".

Example

Note the order in the XML configuration file for the assignment of the colors to alarm number ranges:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE SlAeAlarmAttributes>
<SlAeAlarmAttributes Version="01.00.00.00">
<Types>
   <Type TypeName="Condition" TypeID="32">
     <Category Version="1.0" CatID="1">
        <CatDescr>Alarms of the SINUMERIK 840D sl.</CatDescr>
        <Attributes>
         <Attribute AttrName="TEXTCOLOR" AttrID="5003" AttrDataType="10">
           <AttrDescr>
             Text color of an alarm used when displayed within the header panel.
           </AttrDescr>
         </Attribute>
         <Attribute AttrName="TEXTBACKGROUNDCOLOR" AttrID="5004" AttrDataType="10">
           <AttrDescr>
             Background color of an alarm used when displayed within the header
             panel.
           </AttrDescr>
         </Attribute>
         <Attribute AttrName="NUMBERCOLOR" AttrID="5005" AttrDataType="10">
```

```
            <AttrDescr>
              Text color of an alarm used when displayed within the header panel.
            </AttrDescr>
          </Attribute>
          <Attribute AttrName=" NUMBERBACKGROUNDCOLOR " AttrID="5006"
          AttrDataType="10">
            <AttrDescr> Background color of an alarm used when displayed within the
            header panel.
            </AttrDescr>
          </Attribute>
        </Attributes>
      </Category>
   </Type>
</Types>
<Sources>
   <Source> CatLink="1" SourceID="10000" SourceURL="/HMI">
      <Alarms>
         <Alarm AlarmID="130000">
           <TEXTCOLOR>#000000</TEXTCOLOR>
           <TEXTBACKGROUNDCOLOR>#FFFFFF</TEXTBACKGROUNDCOLOR>
           <NUMBERCOLOR>#FFFFFF</NUMBERCOLOR>
           <NUMBERBACKGROUNDCOLOR>#000000</NUMBERBACKGROUNDCOLOR
         </Alarm>
      </Alarms>
   </Source>
<Source> CatLink="1" SourceID="51" SourceURL="/PLC/PMC">
      <Alarms>
         <Range FromAlarmID="700100" ToAlarmID="700199">
           <TEXTCOLOR>#000000</TEXTCOLOR>
           <NUMBERCOLOR>#00FF00</NUMBERCOLOR>
         </Range>
         <Alarm AlarmID="700000">
           <TEXTCOLOR>#000000</TEXTCOLOR>
           <TEXTBACKGROUNDCOLOR>#FFFFFF</TEXTBACKGROUNDCOLOR>
           <NUMBERCOLOR>#FFFFFF</NUMBERCOLOR>
           <NUMBERBACKGROUNDCOLOR>#000000</NUMBERBACKGROUNDCOLOR
         </Alarm>
      </Alarms>
   </Source>
</Sources>
</SlAeAlarmAttributes>
```

Registering the alarm attribute file

The alarm attribute file with the color definitions must be registered in order that the alarm colors can be assigned to the alarms during the program runtime:

1. You can copy a sample configuration file "oem_slaesvcconf.xml" from the following directory: /**siemens**/sinumerik/hmi/template/cfg
2. Save or create the file in the /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg directory.
3. Name the file "slaesvcconf.xml".
4. Open the file and in the <DataBases> tag enter, for example, the file name of the alarm attribute file without language code and file extension, e.g. "muster_slaedatabase", as "value". The registration of your alarm attribute file starts, for example, with the name "OEM_DataBase_01".

Note

The names of the <DataBases> tag can be freely selected. They must be unique in the system and must not clash with names used by Siemens.

The "Siemens_DataBase_01" name is reserved for Siemens.

If you register additional alarm attribute files, i.e. you wish to include them in the configuration file, use names such as "OEM_DataBase_02", "OEM_DataBase_03", etc.

Restart SINUMERIK Operate

The files still have to be converted into a binary format in order that the alarm colors become effective during the program runtime. This data is only converted during power up.

To do this, restart SINUMERIK Operate. A file with the same name is created with the ".hmi" file extension, e.g. "sample_slaedatabase.hmi" in the same directory in which the alarm attribute file is also located.

The result of the conversion is written to the file "oem_ae_database_conversion.log". This file is located in the "/user/sinumerik/hmi/log" directory.

Note

The conversion is only carried out if the XML file is newer than the associated hmi file.

14.2.5 Replacing standard alarm texts

You can replace alarm texts of the standard SINUMERIK Operate with own alarm texts.

Creating an alarm text file

1. You can copy a sample alarm text file "oem_alarms_eng.ts" from the following directory: /**siemens**/sinumerik/hmi/template/lng
2. Save or create the file in the /**oem**/sinumerik/hmi/lng or /**user**/sinumerik/hmi/lng directory. Create a separate file for each country language that is supported.
3. Assign the file a user-specific name, e.g. "my_nck_alarms_eng.ts". You can freely select the file names with the exception of the language code and the extension.
   The file name always ends with the language code of the particular language and always has the ".ts" extension. For example "my_nck_alarms_deu.ts" for German or "my_nck_alarms_eng.ts" for English.

Creating alarm texts

1. Open the "my_nck_alarms_eng.ts" file.
2. A separate area must be inserted for each alarm text, marked by the <message> tag.
3. The <name> tag contains the context names. Change the name and ensure that the name is unique in the system, e.g. "myNckAlarms".

   Note

   The name for the <name> tag can always be freely selected. However, the name must not clash with the "`slaeconv`" name used by Siemens.

4. The <source> tag contains the alarm number of the standard alarm, e.g. 10000.
5. The <translation> tag contains the actual alarm text, e.g. "OEM alarm text example for NCK alarm 10.000".

Example

```
<!DOCTYPE TS>
<TS>
   <context>
     <name>myNckAlarms</name>
     <message>
       <source>10000/NCK</source>
       <translation> OEM alarm text example for NCK alarm 10.000</translation>
     </message>
   </context>
<TS>
```

Registering the alarm text file

You still have to register your alarm text file so that the system knows your alarm texts during the program runtime:

1. You can copy a sample configuration file "oem_slaesvcadapconf.xml" from the following directory: /**siemens**/sinumerik/hmi/template/cfg
2. Save or create the file in the /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg directory.
3. Assign the name "slaesvcadapconf.xml" to the file.
4. Open the file and in the <BaseNames> tag enter the file name of your alarm text file without language code and file extension, e.g. "my_nck_alarms", as "value". The registration of your alarm text file starts, for example, with the name "Siemens_BaseName_01".

NOTICE
The names of the <BaseNames> tag can be freely selected. They must be unique in the system and must not clash with names used by Siemens. The "Siemens_BaseName_01" name is reserved for Siemens.

Several alarm text files can also be registered. To do this, use names such as "OEM_BaseName_02", "OEM_BaseName_03", etc.

Example:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<!-- Configuration of the Solutionline Alarm & Event Service Adapter -->
<CONFIGURATION>
   <AlarmTexts>
     <BaseNames>
       <OEM_BaseName_01 type="QString" value="my_nck_alarms"/>
   </BaseNames>
   </AlarmTexts>
</CONFIGURATION>
```

Replacing standard alarm texts

You still have to define which standard alarm texts should be replaced by your alarm texts so that during the program runtime, the original alarm text is replaced by your alarm text.

1. Create a new alarm attribute file (see Changing alarm attributes (Page 196)) in the /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg directory. The file name can be freely selected, e.g. "my_nck_alarms_db.xml".
2. Open the file.
3. The file always comprises the two areas <Types> and <Sources>.

4. The <sources> tag includes the reference, assigned to an alarm source, e.g. "\NCK", to the associated alarm text.
5. Link the contents of the <context> <name> tags with the contents of the <message> <source> tags from your alarm text file.
   - <context> <name> = the context name that you assigned
   - <message> <source> = the number of the alarm whose text is to be replaced.
     E.g. enter the following link in the alarm attribute file: <MSGTEXT>myNckAlarms I 10000</MSGTEXT>
     Make sure that the context name and the alarm number are separated by the pipe character "I".
6. If you include an additional NCK alarm, copy the range from <Alarms> to </Alarms> and adapt the alarm number.
7. If you include an additional alarm from another number range (e.g. PLC alarm), copy the range <Sources> to </Sources> and then adapt the SourceID and SourceURL as well as the alarm number.
   You can take the corresponding SourceID and SourceURL from the table in Section Range of alarms (Page 204).

Note

A dedicated link must be created for each standard alarm for which the text is to be replaced.

Example

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE SlAeAlarmAttributes>
<SlAeAlarmAttributes Version="01.00.00.00">
<Types>
   <Type TypeName="Condition" TypeID="32">
     <Category Version="1.0" CatID="1">
       <CatDescr>Alarms of the Sinumerik 810/840 D(i).</CatDescr>
       <Attributes>
       </Attributes>
     </Category>
   </Type>
</Types>
<Sources>
   <Source CatLink="1" SourceID="0" SourceURL="/NCK">
     <Alarms>
       <Alarm AlarmID="10000">
           <MSGTEXT>myNckAlarms|10000/NCK</MSGTEXT>
       </Alarm>
     </Alarms>
   </Source>
</Sources>
</SlAeAlarmAttributes>
```

Registering the alarm attribute file

The alarm attribute file still has to be registered in order that the standard alarm texts are replaced during the program runtime:

1. You can copy a sample configuration file "oem_slaesvcconf.xml" from the following directory: /**siemens**/sinumerik/hmi/template/cfg
2. Save or create the file in the /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg directory.
3. Change the name to "slaesvcconf.xml".
4. Open the file and in the <DataBases> tag enter the name of the alarm attribute file, e.g. <OEM_DataBase_01 type="QString" value="my_nck_alarms_db">

Note

The names of the <DataBases> tag can be freely selected. They must be unique in the system and must not clash with names used by Siemens.

The <Siemens_DataBase_01> tag name is reserved for Siemens.

If you register additional alarm attribute files, i.e. you wish to include them in the configuration file, use the names <OEM_DataBase_02>, <OEM_DataBase_03>, etc.

Restart SINUMERIK Operate

The files with the alarm texts and the attribute file still have to be converted into a binary format in order that the alarm texts can be displayed during the program runtime. This data is only converted during power up.

To do this, restart SINUMERIK Operate. In the same directory where the .ts files or the alarm attribute file are located, files with the same name are created with the ".qm" and .hmi file extension.

The result of the conversion is written to the "alarmtext_conversion.log" or "oem_text_conversion.log" file. Errors that occur during the conversion, such as syntax errors in a parameter file, are also written to the file.

This file is located in the "/user/sinumerik/hmi/log" directory.

Note

The conversion is only made if the .ts file is newer than the associated .qm file.

14.2.6 Range of alarms

Number ranges of alarms

Numerical range	Description		SourceID	SourceURL
000.000 – 009.999	General alarms		0 (standard NCU) 100 (1st NCU) ... 9999 (99th NCU)	/NCK //configuration-spec. designation>//NCK
010.000 – 019.999	Channel alarms			
020.000 – 029.999	Axis/spindle alarms			
030.000 – 039.999	Functional alarms	General		
040.000 – 059.999		Reserved		
060.000 – 064.999		Siemens cycle alarms		
065.000 – 069.999		Cycle alarms user		
070.000 – 079.999		Compile cycles Manufacturer and OEM		
080.000 – 084.999		Siemens cycles message texts		
085.000 – 089.999		User cycles message texts		
090.000 – 099.999		Reserved		
100.000 – 129.999	System		10.000	/HMI
130.000 – 139.999	OEM			
140.000 – 199.999	Reserved			
200.000 – 299.999	SINAMICS drive		0	/NCK
300.000 – 399.999	Drive and I/O alarms			
400.000 – 499.999	General alarms		51	/PLC/PMC
500.000 – 599.999	Channel alarms			
600.000 – 699.000	Axis/spindle alarms			
700.000 – 799.999	User area			
800.000 – 899.999	Sequencers/graphs			
810.000 – 810.009	System error messages		50 150 (1st NCU)	/PLC/DiagBuffer //<configuration-spec. Designation>/PLC/DiagBuffer
900.001 – 965.999	HMI PRO sl Runtime		0	/NCK
966.000 – 999.999	Reserved		0	/NCK

SourceIDs 1 ... 10

The SourceIDs 1 ... 10 have the following relationship:

SourceID	SourceURL
1	/NCK/Channel#1/Partprogram
2	/NCK/Channel#2/Partprogram
3	/NCK/Channel#3/Partprogram
4	/NCK/Channel#4/Partprogram
5	/NCK/Channel#5/Partprogram
6	/NCK/Channel#6/Partprogram
7	/NCK/Channel#7/Partprogram
8	/NCK/Channel#8/Partprogram
9	/NCK/Channel#9/Partprogram
10	/NCK/Channel#10/Partprogram

14.2.7 Parameter specifications in alarm texts

Alarm texts can contain alarm parameters (accompanying values) that specify the cause of an alarm in more detail. These parameters are usually numerical values that are transmitted from an alarm source when the alarm is signaled along with the other alarm data.

How the parameters are incorporated into the alarm text is specified via place holders (parameter specifications) in the language-specific alarm texts, e.g. "Channel **%1** Axis **%2** in machine data **%3** defined for several channels".

When an alarm occurs, the text is replaced by the corresponding parameters, e.g. "Channel **5** Axis **A3** in machine data **4711** defined for several channels".

Standard parameter specifications

The following table shows the standard parameter specifications:

Table 14- 1 Standard parameter specifications

Parameter specifier	Description
%1	First parameter from the alarm data of the alarm source.
%2	Second parameter from the alarm data of the alarm source.
%3	Third parameter from the alarm data of the alarm source.
%4	Fourth parameter from the alarm data of the alarm source.
%5	Fifth parameter from the alarm data of the alarm source. Only for NCK alarms: First part (up to the separator) of the fourth parameter from the alarm data of the alarm source.

Parameter specifier	Description
%7	Seventh parameter from the alarm data of the alarm source Only for NCK alarms: Third part (between the 2nd and 3rd separator) of the fourth parameter from the alarm data of the alarm source.
%8	Eighth parameter from the alarm data of the alarm source Only for NCK alarms: Fourth part (between the 3rd and 4th separator) of the fourth parameter from the alarm data of the alarm source.
%9	Ninth parameter from the alarm data of the alarm source.
%0	Tenth parameter from the alarm data of the alarm source.
%Z	As for %1, in the case of S7-HiGraph alarms the step number of the graph is shown.
%K	Specially for PLC alarms: Second digit of the decimal alarm ID: 1**2**3456, corresponds to channel number (0 = channel 10).
%A	Specially for PLC alarms: Third and fourth digit of the decimal alarm ID: 12**34**56, corresponds to the axis number.
%N	Specially for PLC alarms: Fifth and sixth digit of the decimal alarm ID: 1234**56**, corresponds to the signal number.

14.2.8 Opening error file

The errors that occur during the conversion are written to the "alarmtext_conversion.log" or "oem_text_conversion.log" file.

File loc.: /**user**/sinumerik/hmi/log

Opening the error file

1. Select the "Start-up" operating area.

2. Press the "System data" softkey.
3. Open the "System CF card" folder.
4. Open the storage directory and select the required file.

5. To open the error file, press the "Open" softkey.

- OR -

Press the <INPUT> key.

14.3 Configuring an alarm log

Default

Per default, the alarm log contains all alarms and messages - with their incoming and outgoing time stamps - in chronological order since the last boot. The exceptions are messages from the NC part program (msg command).

Contrary to the "Alarm List" or "Messages" window, all of the alarms or messages that are no longer active when the log is displayed are also displayed (historical alarm events).

Specify the number of results

The alarm log is organized as a ring buffer: When the maximum size is exceeded, the oldest entries are overwritten by the new alarm events. Each incoming or outgoing time stamp represents a separate event.

Persistent storage (permanent storage)

If required, the alarm log can be set up as a persistent log that also contains alarm events from before the last time it was switched on. This means that the log is then either time controlled or for each alarm event, is backed-up in an internal binary format in the file system.

Depending on the hardware being used, for the NCU, the alarm log is saved on the CompactFlash card or for the PC/PCU, on the hard disk.

NOTICE
If the alarm log is written to the CompactFlash card for persistent storage, then only a limited number of write cycles is possible. Therefore, ensure that the storage is only performed when there is a justifiable need! The alarm log is not saved in the default configuration.

Configuring an alarm log

- Via the operator software in the "Diagnostics" operating area
- Via the "slaesvcconf.xml" configuration file

14.3.1 Setting alarm logs from the user interface

Procedure

1. Select the "Diagnostics" operating area.

2. Press the "Alarm log" and "Settings" softkeys.
3. Enter a number in the "Number of entries" field to change the maximum number of administered incoming and outgoing events.

   The alarm log is organized as a ring buffer: When the maximum size is exceeded, the oldest entries are overwritten by the new alarm events. Each incoming or outgoing time stamp represents a separate event.

   You can specify a value between 0 and 32000. Default value is 500.
4. In the "Write mode file" field, under the following entry, select:
   - "off", the changes are not logged (default setting)
   - "for each event", each alarm event immediately initiates that the alarm log is backed-up (persistent save).
   - "time controlled" if the alarm log is to be backed-up again after a certain time. An additional input field called "Time interval" appears in which you can specify a time in seconds.

   You receive a warning if you only save to a CompactFlash card.

NOTICE
Limited number of write cycles Depending on the type of hardware used, the alarm log is either written to the hard disk or to a CompactFlash card. The CompactFlash card, in particular only has a limited number of write cycles. Make sure you undo the setting "on every event" if you no longer require storage of the alarm log.

Restart SINUMERIK Operate

The made settings take effect only after a restart of the operating software. To do this, restart SINUMERIK Operate.

14.3.2 Loading alarm log via configuration file

Creating the configuration file

Adjustments are made in file "slaesvcconf.xml". Copy a sample configuration file "oem_alarmprot_slaesvcconf.xml" from the following directory:
/**siemens**/sinumerik/hmi/template/cfg

Procedure:

1. Save or create the file in the /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg directory.
2. Assign the name "slaesvcconf.xml" to the file.
3. Open the file and enter the number of events to be output in the tag <Records type .../>. The preset value is 500. The maximum number depends on the storage medium (hard disk or CompactFlash card).
4. Enter the backup mode in the <DiskCare type="int" value="-1"/> tag. The following values are possible:
   -1: There is no backup of the alarm log (default setting).
   0: Each alarm event triggers an immediate backup of the alarm log (persistency backup).
   >0: Rhythm of the log saving in seconds: When there is a change, the log is time-triggered saved every n > 0 seconds (persistency backup).
5. You adapt the filter for the entry type in the <Filter> tag. Please observe the following:
   - An alarm event is only entered in the log when it satisfies the filter criterion.
   - If several filters are specified in succession, they are linked by a logical OR.
   - Several filters must be combined in series with the keyword AND for an AND operation.

Note

Each incoming or outgoing event of an alarm or message requires a separate entry, even when they belong to the same alarm or message.

Acknowledgement events are also contained in the alarm log. You require such entries even when these are presently not recognizable in the alarm log.

Filter properties

A filter consists of the following three elements <identification> <relation> <value>.

Entry <identification>	Description
AlarmID	Alarm number
SourceID	Default values for SourceID and SourceURL can be found in the table in Section Range of alarms (Page 204).
SourceURL	
<Attribute name>	Arbitrary alarm attribute from the "slaedatabase.xml" file, such as "SEVERITY" or "CLEARINFO".

Entry <relation>	Description
EQUAL	Equal to
NOT	Not equal to
LOWER	Less than
HIGHER	Greater than

Entry <value>	Description
Numbers	-
Character strings	-

Cancel criteria

Cancel criterion (ClearInfo)	Alarm source (Source)	Description
0	/HMI	Alarms that are canceled by the HMI.
1	/NCK	Alarms that are canceled by power-on of the NCU.
2		Conditions are canceled by a hardware reset of the NCU.
3		Conditions are deleted by a "CANCEL" command to the NCU.
4		Conditions are canceled by the NCK itself.
5		Conditions are canceled by an "NC Start" command on the NCU.
6		Conditions are canceled by a reset of the mode group (BAG).
7		Conditions are canceled by an "NC Reset" command on the NCU.
8	/PLC	PLC messages of the FB15 (basic program).
9		PLC alarms of the FB15 (basic program).
10		Dialog alarms of the HMI that are canceled by the "Recall" key [^].
11		Reserved
12		S7-PDiag, S7-Graph, S7-HiGraph or other Alarm_S(Q) alarms of the PLC (SFC17/18) with alarm state "not acknowledged"
13		S7-PDiag, S7-Graph, S7-HiGraph or other Alarm_S(Q) alarms of the PLC (SFC17/18) with alarm state "acknowledged".
14	/NCK	Drive alarms via NCK.
15	/NCK	Part program messages.

Examples

Log all alarms with a ClearInfo not equal to 15, i.e. no part program messages:

```
<CONFIGURATION>
   <Protocol>
     <Filters>
         <Siemens_Filter_01 type="QString" value="CLEARINFO NOT 15" />
     </Filters>
   </Protocol>
</CONFIGURATION>
```

Log all alarms with the SourceURL "/NCK" or "/HMI":

```
<CONFIGURATION>
   <Protocol>
     <Filters>
         <Filter_01 type="QString" value="SourceURL EQUAL /NCK" />
         <Filter_02 type="QString" value="SourceURL EQUAL /HMI" />
     </Filters>
   </Protocol>
</CONFIGURATION>
```

In the <FilePath> tag, adapt the path and file name for the file in which the alarm log is stored persistently:

```
<CONFIGURATION>
   <Protocol>
     <Filters>
       <FilePath type="QString" value="$(HMI_INSTALL_DIR)user/sinumerik/hmi/
       log/alarm_log/slaepp_" />
     </Filters>
   </Protocol>
</CONFIGURATION>
```

- Path
  Environment variables can also be incorporated in the path, e.g. for the installation directory: $(HMI_INSTALL_DIR).
- File name:
  A 3-digit number and the file extension "hmi" are automatically added to the specified file name during operation, e.g. "slaepp_123.xml". The number is automatically increased when:
  - The file has reached the maximum size (DiskCare = 0), or
  - The specified period has elapsed (DiskCare > 0).
    Older files are deleted.

NOTICE
The CompactFlash card only allows a limited number of write cycles! Therefore, ensure that the storage is only performed when there is a justifiable need! The alarm log is not saved in the default configuration.

Example: Switching off existing filters

To switch off the existing Siemens filter - without overwriting the filter - proceed as follows:

1. An "empty" filter switches off **all** previously set filters.

   Knowledge of the filter designation is not required.
2. For the effect of the filters, the order in which they are set is important:

   siemens → addon → oem → user

Example of the filtering of alarms 700000 to 700200:

```
<CONFIGURATION>
   <Protocol>
     <Filters>
         <Filter_00 type="QString" value="" />
         <Filter_01 type="QString" value="CLEARINFO NOT 15 AND AlarmID LOWER
         700000"/>
         <Filter_02 type="QString" value="CLEARINFO NOT 15 AND AlarmID HIGHER
         700200"/>
     </Filters>
   </Protocol>
</CONFIGURATION>
```

Result

For the changes to the protocol settings to take effect, restart SINUMERIK Operate.

14.4 PLC alarms with parameters

Introduction

For alarms that are triggered via the PLC blocks SFC17 and SFC18, a parameter can be transferred each time the block is called. If the "Octet string" data type is selected, up to 12 bytes can be transferred.

With an appropriate configuration of the operating software, a maximum of 12 bytes can be interpreted, e.g. also as an array of bytes or as a structure with any order of simple data types. In this way, several parameters can be displayed in the alarm text.

A parameter description must be stored for each alarm in the operating software. Two aspects must be taken into account with this parameter description:

- How the parameter has to be interpreted correctly (data type and, if necessary, length)
- How the parameter has to be prepared for display (string or number, decimal, hexadecimal, binary, etc.)

Point 1 is irrespective of the language selected for the display, point 2 can be different depending on the national language.

The possible parameter descriptions are therefore divided into a language-independent parameter statement and a language-dependent format statement and stored in the following directories:

- Parameter statement: /oem/sinumerik/hmi/cfg/ or /user/sinumerik/hmi/cfg/
- Format statement: /oem/sinumerik/hmi/lng or /user/sinumerik/hmi/lng

The names of the files can be freely selected. The parameter statement is added to the configured data of the relevant alarm in the database in the form of the alarm attribute "HMIPROPARAMDESCR2". Because of the language dependency, the format statement is part of the alarm text.

14.4.1 Definition of a parameter of the octet string data type

Parameter statement

The parameter statement describes how one or more parameters can be defined with the maximum 12-bytes long octet string supplied with the alarm PDU.

Syntax

The following syntax applies for the parameter statement:

<Parameter directive ext>	::=	[% <Parameter description>]
<Parameter description ext>	::=	<No. of the associated value><Element type><Offset>
<No. of the associated value>	::=	Always 1 (reserved for future applications)
<Offset>	::=	Data type-dependent offset of the parameter within the associated value: • BOOL data type (B): Bit offset within the associated value • All except for BOOL data type (Y, W, X, I, D, C, R): Byte offset within the associated value

Element type	Data type
Y	BYTE (8-bit, unsigned)
W	WORD (16-bit, unsigned)
X	DWORD (32-bit, unsigned)
I	INTEGER (16-bit, signed)
D	INTEGER (32-bit, signed)
B	BOOL (1-bit)
C	CHAR (8-bit)
R	REAL (32-bit)

Examples

%1W0%1W2	→	1st parameter: 1st associated value, WORD at byte offset 0 2nd parameter: 1st associated value, WORD at byte offset 2
%1Y0%1Y1%1W2	→	1st parameter: 1st associated value, BYTE at byte offset 0

		2nd parameter: 1st associated value, BYTE at byte offset 1 3rd parameter: 1st associated value, WORD at byte offset 2
%1B0%1B1%1B2%1B3%1I1	→	1st parameter: 1st associated value, BOOL at bit offset 0 2nd parameter: 1st associated value, BOOL at bit offset 1 3rd parameter: 1st associated value, BOOL at bit offset 2 4th parameter: 1st associated value, BOOL at bit offset 3 5th parameter: 1st associated value, INTEGER (16-bit, signed) at byte offset 1

Example of an alarm attribute file (how to create an alarm attribute file, see Changing alarm attributes (Page 196)):

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<SlAeAlarmAttributes Version="01.00.00.00">
<Types>
  <Type TypeID="32" TypeName="Condition">
  <Category CatID="1" Version="1.0">
 <CatDescr>Alarms of the SINUMERIK 840D sl.</CatDescr>
    <Attributes>
      <Attribute AttrName="MSGTEXT" AttrID="-1" AttrDataType="10"/>
      <Attribute AttrName="HMIPROPARAMDESCR2" AttrID="5012" AttrDataType="10"/>
    </Attributes>
  </Category>
  </Type>
</Types>
<Sources>
  <Source CatLink="1" SourceID="51" SourceURL="/PLC/PMC">
    <Alarms>
 <!-- Alarm 700000 with three BYTE parameters -->
      <Alarm AlarmID="700000">
        <MSGTEXT>my_oem_plc_alarms_context|700000/PLC/PMC</MSGTEXT>
        <HMIPROPARAMDESCR2>%1Y0%1Y1%1Y2</HMIPROPARAMDESCR2>
      </Alarm>
 <!-- Alarm 700001 with three WORD parameters -->
      <Alarm AlarmID="700001">
        <MSGTEXT>my_oem_plc_alarms_context|700001/PLC/PMC</MSGTEXT>
        <HMIPROPARAMDESCR2>%1W0%1W2%1W4</HMIPROPARAMDESCR2>
```

```
      </Alarm>
 <!-- Alarm 700002 with three 16-bit INTEGER parameters -->
      <Alarm AlarmID="700002">
        <MSGTEXT>my_oem_plc_alarms_context|700002/PLC/PMC</MSGTEXT>
        <HMIPROPARAMDESCR2>%1I0%1I2%1Y4</HMIPROPARAMDESCR2>
      </Alarm>
 <!-- Alarm 700003 with four parameters: BYTE -> WORD -> 32-bit INTEGER -> BYTE -->
      <Alarm AlarmID="700003">
        <MSGTEXT>my_oem_plc_alarms_context|700003/PLC/PMC</MSGTEXT>
        <HMIPROPARAMDESCR2>%1Y0%1W1%1D3%1Y7</HMIPROPARAMDESCR2>
      </Alarm>
    </Alarms>
  </Source>
</Sources>
</SlAeAlarmAttributes>
```

14.4.2 Definition of the language-dependent formatting

Format statement

The format statement is part of the alarm text and is used as a placeholder for a parameters to be displayed.

Syntax

The following syntax applies for the format statement:

<Format directive>	::=	@ <No. of the parameter description><Format specification> @
%[i]x	::=	Hexadecimal number with i digits
%[i]u	::=	Decimal number without sign with i digits
%[i]d	::=	Decimal number with sign with i digits (incl. sign)
%[i]b	::=	Binary number with i digits
%[i][.y]f	::=	Fixed-point number: Signed value of the form [-]xxx.yyyy, where i specifies the total number of digits including sign and decimal point and y specifies the number of digits after the decimal point. Missing digits both before and after the decimal point are filled with 0. If there are more places after the decimal point than permitted by y, this is rounded off.

If the optional digit specification i is not specified, then only the number of digits is used required to completely display the number. The same applies when the number of digits specified by i is not sufficient to completely display the number including sign, i.e. i is then ignored.

The number contained in the format statement does not relate to the position of the associated value in the alarm PDU, but to the position of the parameter description in the parameter statement. Any number of format statements can be present in an alarm text.

Examples

@1%b@ → Value from the first parameter description to be displayed as a binary number, e.g. "1011011"

@2%8X@ → Value from the second parameter description to be displayed as a hexadecimal number with eight digits, missing digits are filled with 0, e.g. "00AF37FE"

@1%7.2f@ → Value from the first parameter description to be displayed as a fixed point number with seven digits (incl. sign and decimal point) and two digits after the decimal point, missing digits are filled with 0, e.g. "-012.34"

Example of an alarm text file (how you create alarm texts, see Creating in-house alarm texts (Page 188)):

```
<!DOCTYPE TS>
<TS>
<context>
  <name>my_oem_plc_alarms_context</name>
  <message>
    <source>700000/PLC/PMC</source>
    <translation>Text with three BYTE parameters: @1%X@, @2%u@, @3%b@</translation>
  </message>
  <message>
    <source>700001/PLC/PMC</source>
    <translation>Text with three WORD parameters: @1%X@, @2%u@, @3%b@</translation>
  </message>
  <message>
    <source>700002/PLC/PMC</source>
    <translation>Text with three 16-bit INTEGER parameters: @1%X@, @2%u@, @3%b@</translation>
  </message>
  <message>
    <source>700003/PLC/PMC</source>
    <translation>Text with four parameters: @1%X@, @2%u@, @3%r@, @4%b@</translation>
  </message>
```

```
</context>
</TS>
```

14.5 Deactivating a warning

Generally, alarms/messages are not used without alarm texts. If the alarm text is missing, the warning "No text available" is output.

To deactivate the warning, add the <ControlFlags> area to your "slaesvcadapconf.xml" configuration file.

You can copy this area from the original file. The "slaesvcadapconf.xml" file is in the following directory: /**siemens**/sinumerik/hmi/base

Setting

In the <MissingTextWarning type="bool" value="FALSE"/> tag, deactivate/activate the warning.

Entry	Meaning
TRUE	The warning is displayed.
FALSE	The warning is deactivated.

Example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<CONFIGURATION>
        <ControlFlags>
            <MissingTextWarning type="bool" value="FALSE"/>
        </ControlFlags>
</CONFIGURATION>
```

Data backup

15

Data backup

The following times are recommended for performing a data backup:

- After a start-up
- After changing machine-specific settings
- after replacing a hardware component
- For a software upgrade
- Before the activation of memory-configuring machine data

Note

A start-up archive is saved as a file of the type ".arc" (archive). If required, archives can be processed using the SinuCom commissioning and service tool SinuCom ARC.

There are various ways of creating and reloading archives via the SINUMERIK Operate user interface.

- Data can be selected specifically in the data tree and backed up using the "System data" softkey.
- The "Start-up archive" softkey offers the following selection:
  - Create and read-in a start-up archive
  - Create PLC hardware upgrade archive (only SDBs)
  - Creating and reading in archive of original status

Storage locations

Archives can be stored in the following directories:

- CompactFlash card at: System CF-Card/**user**/sinumerik/data/archive or System CF-Card/**oem**/sinumerik/data/archive
- PCU: F:hmisl**user**\sinumerik\data\archive or **oem**\sinumerik\data\archive
- All configured logical drives (USB, network drives)

NOTICE
USB FlashDrive
USB FlashDrives are not suitable as persistent memory media.

15.1 Creating a start-up archive

Overview

A start-up archive can be generated, for example, after the controller has been commissioned. To do this, control components can be saved individually or jointly. It is also possible to transfer the backed-up data to other controllers so that they can be updated to the same status.

Precondition

You require at least access level 2 (service).

Data of the control components

Control components		Data
NC data		Machine data Setting data Option data Global (GUD) and local (LUD) user data Tool and magazine data Protection zone data R parameters Zero offsets Workpieces, global part programs and subprograms Standard and user cycles Definitions and macros
	With compensation data	• QEC - quadrant error compensation • CEC - operation/angularity compensation • EEC - leadscrew pitch / encoder error compensation It only makes sense to archive machine-specific compensation data if the start-up file is reloaded into the same controller.
	with compile cycles	Compile cycles (*.elf) are displayed, if compile cycles are available.
PLC data		OB (organization blocks) FB (function blocks) SFB (system function blocks) FC (functions) SFC (system functions) DB (data blocks) SDB (system data blocks)
Drive data		Archiving the drive data, either in the binary or ASCII format.
HMI data, all		

Control components		Data
HMI data, selection:		If data is available, you must set the tick in order to activate the components.
	Texts	User texts, alarm texts
	Templates	Individual templates, workpiece templates
	Applications	HMI applications, OEM applications
	Configurations	Configurations
	Configuration	Configuration, incl. display machine data
	Help	Help files
	Version data	Version data
	Logs	Error logs
	Program lists	Program lists
	Dictionaries	Dictionaries
	Data backups	Files located in the data tree of the "System data" in the "HMI data / data backups" directory.
	Programs on local drive	Programs contained in the user memory area of the CompactFlash card.
Comment		Entry field for possible comments regarding the start-up archive.
Created by		Entry field for the creator as well as creation date of the start-up archive.

Procedure

1. Select the "Start-up" operating area.

2. Press the menu forward key.

3. Press the "Start-up archive" softkey.
   The "Start-up" window opens.

4. Activate "Create a start-up archive" and press the "OK" softkey.
   The "Create Start-up Archive" window opens.
5. Select the desired control components.
6. When required, enter a comment as well as your name and the date of creation.

7. Press the "OK" softkey.
   The "Generate Archive: Select Storage Location" window opens.

8. Position the cursor at the required storage location, press the "Search" softkey and enter the required search term in the search dialog. Then press the "OK" softkey if you wish to search for a certain directory or subdirectory.

Note: The placeholders "*" (replaces any character string) and "?" (replaces any character) make it easier for you to perform a search.

- OR -

Select the required storage location, press the "New directory" softkey, enter the required name in the "New Directory" window and press the "OK" softkey in order to create a directory.

9. Press the "OK" softkey.

   The "Generate Archive: Name" window opens.

10. Enter the required name and press the "OK" softkey.

    An archive file with the ARC format type is stored in the selected directory.

15.2 Reading-in a start-up archive

NOTICE
To prevent the NCU from shutting down unintentionally, you must disable all energy saving profiles before you read in a start-up archive. For more detailed information about the energy saving profiles topic, see: Operating Manuals for SINUMERIK Operate, "Ctrl-Energy" section.

Procedure

1. Select the "Startup" operating area.

Press the menu forward key.

2. Press the "Start-up archive" softkey.

3. Activate "Read-in a start-up archive" and press the "OK" softkey.
   The "Select Start-up Archive" window opens.

4. Select a storage location and position the cursor at the required start-up archive (ARC).

   - OR -

   Select the required storage location, press the "Search" softkey and enter the required search term. Then press the "OK" softkey if you wish to search for a certain directory, subdirectory or start-up archive.

5. Press the "OK" softkey.
   The "Read-in Start-up Archive" window opens.
   You obtain an overview with path details, version information, name of the archive, etc., as well as a list of the archived components.
   Remove the tick of a checkbox to exclude a component from the read-in process.

6. Press the "OK" softkey to download the selected archive file.
   The "Read-in Archive" window opens and a progress message box appears for the read-in process.

7. Press the "Overwrite all" softkey if you wish to overwrite the existing files.

   - OR -

   Press the "No overwriting" softkey if you wish to keep existing files.

   - OR -

   Press the "Skip" softkey if you only wish to overwrite certain files.
   You will then obtain a "Read error log for archive" in which the skipped or overwritten files are listed.

8. Press the "Cancel" softkey to cancel the read-in process.

15.3 Backing up the hardware configuration

The hardware is configured via the system data blocks (SDB) and only these are stored in the archive.

Procedure

1. Select the "Start-up" operating area.

Press the menu forward key.

2. Press the "Start-up archive" softkey.
   The "Start-up" window opens.

3. Activate "Create PLC hardware upgrade archive (SDBs only)" and press the "OK" softkey.
   The "Create PLC hardware upgrade archive (SDBs only): Select Storage Location" window opens.
4. Select the desired storage location in the displayed data tree.
   - OR -

   Press the "New directory" softkey to create a separate directory.
   The "New Directory" window opens.

5. Enter the required name and press the "OK" softkey.
   The directory is created below the created folder.

6. Press the "OK" softkey.
   The "Generate Archive: Name" window opens.

The file type of the archive is ARC and is displayed in the window. Enter the desired name and press the "OK" softkey.
The archive is generated and stored in the selected directory.

15.4 Creating an archive with original data

You can select this type of start-up in order to save the original status of the controller. The files are archived in the "original.arc" file.

The file is stored on the CompactFlash card in the Archives/Manufacturer directory.

If there is no "original.arc" file in the directory, it is recommended that an archive be generated from the data of the original controller state as delivered.

As for "Create start-up", control components can be saved individually or jointly.

Precondition

In order to save NC data, you require the access level 2 (service).

To back up programs/workpieces, you need access level 6 (keyswitch position 1).

Data of the control components

Control components		Data
NC data		Machine data Setting data Option data Global (GUD) and local (LUD) user data Tool and magazine data Protection zone data R parameters Zero offsets Compensation data Workpieces, global part programs and subprograms Standard and user cycles Definitions and macros
	With compensation data	• QEC - quadrant error compensation • CEC - operation/angularity compensation • EEC - leadscrew pitch / encoder error compensation • It only makes sense to archive machine-specific compensation data if the series start-up file is reloaded into the same controller.
	with compile cycles	Compile cycles (*.elf) are displayed, if compile cycles are available.

Control components		Data
PLC data		OB (organization blocks) FB (function blocks) SFB (system function blocks) FC (functions) SFC (system functions) DB (data blocks) SDB (system data blocks)
HMI data, all		
HMI data, selection:		
	Cycle storage	Definitions and cycles
	Texts	User texts, alarm texts
	Templates	Individual templates, workpiece templates
	Applications	HMI applications, OEM applications
	Configurations	Configurations
	Configuration	Configuration, incl. display machine data
	Help	Help files
	Version data	Version data
	Logs	Error logs
	User views	Individually compiled tables with selected machine and setting data.
	Dictionaries	Dictionaries
	Programs on local drive	Programs contained in the user memory area of the CompactFlash card.

Procedure

1. Select the "Start-up" operating area.

2. Press the menu forward key.

3. Press the "Start-up archive" softkey.
   The "Start-up" window opens.

4. Activate the "Create archive of original status" checkbox and press the "OK" softkey.
   The "Create Start-up for Original Status" window opens.
5. Select the desired control components.

6. When required, enter a comment into the field as well as your name and the date of creation - and then press the "OK" softkey.
   A warning is output if an "original.arc" archive file already exists.

7. Press the "OK" softkey to overwrite the file.
   A new archive file is generated and stored in the Archives/Manufacturer directory.
   - OR -

   Press the "Cancel" softkey so that the existing file is not overwritten.

15.5 Reading in an archive with original data

The data of the original controller state is stored in the "original.arc" file. If you want to restore the controller to the as-delivered state, you can read in the original data archive.

Precondition

You require access level 3 (user).

Procedure

1. Select the "Start-up" operating area.

2. Press the menu forward key.

3. Press the "Start-up archive" softkey.
   The "Start-up" window opens.

4. Activate the "Read in archive of original status" checkbox and press the "OK" softkey.
   SINUMERIK Operate automatically accesses the "original.arc" file.
   A window opens prompting whether you want to perform a start-up.

5. Press the "OK" softkey.
   The read-in process is started and a progress message box is displayed in the window.
   Any errors that occur are then displayed in the "Write Error Log for Archive" window.

15.6 Generating the complete archive

You have the option of generating an archive of the complete data of your control on an external storage medium that you can provide to Technical Support for diagnostic purposes.

Procedure

1. Insert the storage medium in the USB port.
2. Press the key combination <Ctrl> + <Alt> + S.
   All data required for diagnostics are compiled in an archive. Operator control is not possible while the archive is being generated.
3. You will receive a message once archiving has been completed.
   The system assigns an archive name and this is: CompletArchiv<Date>_<Time>.arc.
   The dialog box is closed and you can re-operate the control.

15.7 Serial interface (V24 / RS232)

15.7.1 Reading-in and reading-out archives

Availability of the RS-232-C serial interface

You have the option of reading-out and reading-in archives in the "Program manager" operating area as well as in the "Start-up" operating area via the RS-232-C serial interface.

- SINUMERIK Operate on the NCU:

  The softkeys for the RS-232-C are available as soon as an option module is connected and the slot is occupied.

- SINUMERIK Operate on the PCU:

  The softkeys for the RS-232-C are always available.

Reading-out archives

The files to be sent (directories or individual files) are zipped in an archive (*.ARC). If you send an archive (*.arc), this is sent directly without being additionally zipped. If you have selected an archive (*.arc) together with an additional file (e.g. directory), then these are zipped into a new archive and are then sent.

Reading-in archives

Only archives can be read-in via the RS-232-C. These are transferred and then subsequently unzipped.

Note

Start-up archive

If you read in a start-up archive via the RS-232-C, then this is immediately activated.

Externally processing the punched tape format

If you wish to externally process an archive, then generate this in the punched tape format. Using the SinuCom commissioning and service tool SinuCom ARC, you can process the archive in the binary format and in the commissioning archive.

Procedure

...

1. Select the "Program manager" operating area, and press the "NC" or "Local drive" softkey.

- OR -

Select the "Start-up" operating area and press the "System data" softkey.

Reading-out archives

2. Select the directories or the files that you wish to send via RS-232-C.

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

4. Press the "RS-232-C send" softkey.

- OR -

Reading in an archive

Press the "RS-232-C receive" softkey if you wish to read-in files via RS-232-C.

15.7.2 Setting interface parameters

Procedure

1. Select the "Start-up" operating area.

2. Press the "System data" softkey.

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

4. Select the "RS-232-C settings" softkey.
   The "Interface: RS-232-C" window is opened and the interface settings are displayed.

5. Press the "Details" softkey if you wish to view and process additional settings for the interface.

RS-232-C settings

Parameter	Meaning
Protocol	The following protocol is supported for transfer via the RS-232-C: • RTS/CTS
Transfer	It is also possible to use a secure protocol for data transfer (ZMODEM protocol). • Normal (default setting) • Secure For the selected interface, secure data transfer is set in conjunction with handshake RTS/CTS.

Parameter	Meaning
Baud rate	Transfer rate: Transfer rates of up to 115 kbaud can be selected. The baud rate that can be used depends on the connected device, the cable length and the general electrical conditions. • 110 • .... • 19200 (default setting) • ... • 115200
Archive format	• Punched tape • Binary format (PC format)
RS-232-C settings (details)	
Interface	• COM1 • COM2 only relevant for SINUMERIK Operate on PC
Parity	Parity bits are used for error detection: The parity bits are added to the coded characters to make the number of positions set to "1" an uneven number (uneven parity) or to an even number (even parity). • None (default setting) • Odd • Even
Stop bits	Number of stop bits for asynchronous data transfer. • 1 (default setting) • 2
Data bits	Number of data bits for asynchronous data transfer. • 5 bits • ... • 8 bits (default setting))
XON (hex)	Only for punched tape format
XOFF (hex)	Only for punched tape format
End of data transfer (hex)	Only for punched tape format Stop with end of data transfer character The default setting for the end of data transfer character is (HEX) 1A.
Time monitoring (sec)	Time monitoring For data transfer problems or at the end of data transfer (without end of data transfer character) data transfer is interrupted after the specified number of seconds. The time monitoring is controlled by a time generator (clock) that is started with the first character and is reset with each transferred character. The time monitoring can be set (seconds).

15.8 Backing up setup data

Setting for "Backup setup data"

The "Backup setup data" function should only be used if MD11280 $MN_WPD_INI_MODE is set to 1 (default setting). Otherwise, when the NC is started for the first time after selecting the part program, a file with the same name with the ".ini" extension would be automatically executed.

Machine data:

MD11280 $MN_WPD_INI_MODE		
Processing mode of ini files in the workpiece directory		
= 1	When the NC is started for the first time, after the workpiece selection, ini files with the name of the selected part program and the following extensions are executed:	
	CEC	Sag compensation (Cross Error Compensation)
	GUD	User data (Global User Data)
	PRO	Protection zones
	RPA	R parameters
	SEA	Value assignments (Setting Data Active)
	TMA	Magazine data (Tool Magazine Active)
	TOA	Tool offsets (Tool Offset Active)
	UFR	Work offsets (User Frame)

15.9 Network settings

Activate

By default, the network settings cannot be backed up. The archiving of the network settings must be enabled:

1. Copy the "slpmconfig.ini" file from the /siemens/sinumerik/hmi/template/cfg directory.
2. Store the file in the /oem/sinumerik/hmi/cfg or /user/sinumerik/hmi/cfg directory.
3. Open the file and enter the following for [SeriesSetup]:

   SupportNetworkSettings=true
4. Restart SINUMERIK Operate.

Note

This setting also affects the creation of a complete standard archive using Ctrl+Alt+S or Ctrl+Alt+C.

Restrictions

- The leases files are not saved:
  - /system/etc/udhcpd-eth0.leases
  - /system/etc/udhcpd-ibn0.leases
- A configuration in the system network must be based on the DNS name rather than IP addresses.

Basic procedure

- Backup of network settings

  After activation, the network settings can also be backed up when a commissioning archive is created when a check mark is set, see Creating a start-up archive (Page 220).
- Importing network settings

  The saved archives can be imported in the same manner as a commissioning archive, see Reading-in a start-up archive (Page 222).

NOTICE
Importing network settings for replacement components Disconnect the replacement components from the system network before you import the saved network settings.

NCU

Only the NCU settings are saved with the HMI on the NCU. The following data is backed up:

- /user/system/etc/basesys.ini
- /user/common/tcu (complete directory)

The network settings of an NCU can be backed up and read only from an HMI on the PC/PG. This means the NC address in mmc.ini on the PC/PG is always 192.168.215.1.

PCU

PCU and, if applicable, NCU settings saved with the HMI on the PCU. The following data is backed up:

- PCU
  - /user/system/etc/basesys.ini
  - mmc.ini for SINUMERIK Operate
- NCU (when present as master)
  - /user/system/etc/basesys.ini
  - /user/common/tcu (complete directory)

The following archives are created: Archivename_pcu.arc and Archivename_ncu.arc

Importing an archive for a configuration with NCU as master (DHCP) and PCU (on_low):

1. Import the archive for Archivename_pcu.arc on a PCU with SINUMERIK Operate.
2. Depending on the replaced parts of the NCU, note the following:
   – If the NCU was not replaced, the system restarts.
   – The NCU has been replaced, Archivename_ncu.arc must be imported via the X127 interface with a separate HMI.

Service and diagnostics 16

16.1 NC/PLC variables

16.1.1 Displaying and editing PLC and NC variables

The "NC/PLC Variables" window allows NC system variables and PLC variables to be monitored and changed.

You receive the following list in which you can enter the desired NC/PLC variables in order to display the actual values.

- Variable

  Address for NC/PLC variable.

  Incorrect variables have a red background and are displayed with a # character in the value column.

- Comment

  Any comment on the variable.

  The columns can be displayed and hidden.

- Format

  Specify the format in which the variable is to be displayed.

  The format can be specified (e.g. floating point).

- Value

  Displays the actual value of the NC/PLC variables.

PLC variables	
Inputs	Input bit (Ex), input byte (EBx), input word (EWx), input double word (EDx)
Outputs	Output bit (Ax), output byte (ABx), output word (AWx), output double word (ADx)
Bit memory	Memory bit (Mx), memory byte (MBx), memory word (MWx), memory double word (MDx)
Times	Time (Tx)
Counters	Counter (Cx)
Data	Data block (DBx): Data bit (DBXx), data byte (DBBx), data word (DBWx), data double word (DBDx)

Formats	
B	Binary
H	Hexadecimal
D	Decimal without sign
+/-D	Decimal with sign
F	Floating point (for double words)
A	ASCII character

Notation for variables

- PLC variables

  EB2

  A1.2

  DB2.DBW2
- NC variables
  - NC system variables - notation

    $AA_IM[1]
  - User variables/GUDs - notation

    GUD/MyVariable[1,3]
  - OPI - notation

    /CHANNEL/PARAMETER/R[u1,2]

Note

NC system variables and PLC variables

- System variables can be dependent on the channel. When the channel is switched over, the values from the corresponding channel are displayed.
- For user variables (GUDs) it is not necessary to make a specification according to global or channel-specific GUDs. The indices of GUD arrays are, just like NC variables in the system variable syntax, 0-based; this means that the first element starts with the index 0.
- Using the tooltip, for NC system variables, you can display the OPI notation (with the exception of GUDs).

Changing PLC variables

Changes can only be made to the PLC variables with the appropriate password.

DANGER
Changes in the states of NC/PLC variables have a major impact on the machine. Incorrect configuration of the parameters can endanger human life and cause damage to the machine.

Changing and deleting values

1. Select the "Diagnostics" operating area.

2. Press the "NC/PLC variables" softkey.

   The "NC/PLC Variables" window opens.

3. Position the cursor in the "Variable" column and enter the required variable.

4. Press the <INPUT> key.

   The operand is displayed with the value.

5. Press the "Details" softkey.

   The "NC/PLC Variables: Details" window opens. The information for "Variable", "Comment" and "Value" are displayed in the full length.

6. Position the cursor in the "Format" field and choose the required format with <SELECT>.

7. Press the "Display comments" softkey.

   The "Comments" column is displayed. You have the option of creating comments or editing existing comments.

   Press the "Display comments" softkey once again to hide the column again.

8. Press the "Change" softkey if you would like to edit the value.

   The "Value" column can be edited.

9. Press the "Insert variable" softkey if you wish to select a variable from a list of all of the existing variables and insert this.

   The "Select Variable" window opens.

10. Press the "Filter/search" softkey to restrict the display of variables (e.g. to mode groups-variables) using the "Filter" selection box and/or select the desired variable using the "Search" input box.

Press the "Delete all" softkey if you would like to delete the entries for the operands.

11. Press the "OK" softkey to confirm the changes or the deletion.

- OR -

Press the "Cancel" softkey to cancel the changes.

Note

"Filter/Search" when inserting variables

The start value for "Filter/Search" of variables differs.

For example, to insert the variable $R[0], set "Filter/Search":

- The start value is 0, if you filter according to "System variables".
- The start value is 1, if you filter according to "All (no filter)". In this case, all signals are displayed and shown in the OPI notation.

Changing operands

Depending on the type of operand, you can increment or decrement the address by 1 place at a time using the "Operand +" and "Operand -" softkeys.

Note

Axis names as index

For axis names, the softkeys "Operand +" and "Operand -" do not act as index, e.g. for $AA_IM[X1].

Examples

DB97.DBX2.5

Result: DB97.DBX2.6

$AA_IM[1]

Result: $AA_IM[2]

MB201

Result: MB200

/Channel/Parameter/R[u1,3]

Result: /Channel/Parameter/R[u1,2]

16.1.2 Saving and loading screen forms

You have the option of saving the configurations of the variables made in the "NC/PLC variables" window in a screen form that you reload again when required.

Editing screen forms

If you change a screen form that has been loaded, then this is marked using with * after the screen form name.

The name of a screen form is kept in the display after switching-off.

Procedure

1. You have entered values for the desired variables in the "NC/PLC variables" window.

2. Press the ">>" softkey.

3. Press the "Save screen" softkey.
   The "Save screen: Select archiving" window opens.

4. Position the cursor on the template folder for variable screen forms in which your actual screen form should be saved and press the "OK" softkey.
   The "Save screen: Name" window opens.

5. Enter the name for the file and press the "OK" softkey.
   A message in the status line informs you that the screen form was saved in the specified folder.
   If a file with the same name already exists, they you will receive a prompt.

6. Press the "Load screen" softkey.
   The "Load screen" window opens and displays the sample folder for the variable screen forms.
7. Select the desired file and press the "OK" softkey.
   You return to the variable view. The list of all of the predefined NC and PLC variables is displayed.

16.1.3 Loading PLC symbols to the controller

Requirement

You require the SIMATIC STEP 7 software and the "PLC Symbols Generator" program that is provided in the toolbox.

Generating PLC symbols

To edit PLC blocks via symbolic names, you can generate the symbols of the STEP 7 project for SINUMERIK Operate and store them on the CompactFlash card on the controller.

Procedure:

1. Open the "PLC Symbols Generator" program and navigate to the corresponding PLC project.
2. To start the generation, first select the required language.
3. Save the "PlcSym.snh" and "PlcSym_xx.snt" files. xx is the language code specified when creating the file. The generation is then started.
4. Create the following directory on the CompactFlash card and store the generated files (PlcSym_xx.snt, PlcSym.snh) under the following path: **/oem**/sinumerik/plc/symbols
5. After restarting SINUMERIK Operate, the symbol tables are loaded when booting. Select the "Insert variables" softkey to display the imported symbols in the table of the "NC/PLC variables".

16.2 Displaying the Service overview

Status displays

The status of each machine axis is displayed in the "Service Overview" window.

Information for up to 31 machine axes can be displayed. A column for each available axis is created for this purpose.

Display icon		Meaning
	Green	The axis is behaving normally.
	Yellow	The axis is not ready.
	Red	An alarm is pending for this axis.
	Gray	The axis is not affected.
-	Dash	No drive assigned to axis.
#	Special characters	Error when reading the data, e.g. if data is not available.

Enable displays

From NC: On/Off1

From NC: Off2

From NC: Off 3

From the drive: Operation enabled

From the infeed: Enable operation

Pulse enable NC

Speed controller enable NC

Enable pulses

Drive ready

Heat sink temperature

Power section in i^2t limiting

Motor temperature

Measuring system 1 active

Measuring system 2 active

Procedure

1. Select the "Diagnostics" operating area.

2. Press the menu forward key.
   New horizontal softkeys are displayed.

3. Press the "Axis diagn." softkey.
   The "Service Overview" window opens.

16.2.1 Selecting axes

Procedure

To display certain enables and statuses of machine axes, you can arrange a selection of all the axes that are available in any order you wish.

1. Select the "Diagnostics" operating area.

2. Press the menu forward key.
   New horizontal softkeys are displayed.

3. Press the "Axis diagn." softkey.
   The "Service Overview" window opens.

4. Press the "Change overview" softkey.
   A new softkey bar is displayed.

5. If you want to display the information relating to the axes that are active, press the "Active axes" softkey. This will display the axes to which a real drive is assigned.

   - OR -

   Press the "All axes" softkey if you want the information for all axes to be displayed. This will display all the axes that are defined in at least one channel.

   - OR -

   Press the "Change selection" softkey if you want to make a new axis selection to be displayed.

   The "Change Selection" window opens and the previous axis list is displayed.

6. Enter the required axes.
   The axes entered must be separated by blanks.

7. Press the "OK" softkey to confirm your selection.

8. If you press the "Select. axes" softkey, the axes configured with "Change selection" will be displayed.

9. If you click the "Back" softkey, you will return to the "Service Overview" main screen.

16.2.2 Service axis

Displaying axis data

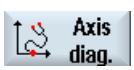
The following information is displayed in the "Service Axis/Spindle" window:

- Check of the setpoint branch (e.g. programmed position setpoint, speed setpoint, spindle speed setpoint)
- Check of the actual value branch (e.g. actual position value, measuring system ½, actual speed value)
- Optimization of the position control loop of the axis (e.g. following error, control deviation, servo gain factor)
- Check of the entire control loop of the axis (e. g. through position setpoint / actual-value comparison and speed setpoint / actual-value comparison)
- Check of hardware errors (e.g. by checking the encoder: If the axis is moved mechanically, the actual position value must change)
- Setting and check of the axis monitoring functions.

Procedure

1. Select the "Diagnostics" operating area.

2. Press the menu forward key.
   New horizontal softkeys are displayed.



3. Press the "Axis diagnostics" softkey.
   The "Service Overview" window opens.

4. Press the "Service axis" softkey.
   The "Service Axis/Spindle" window opens.

5. Press the "Axis +" or "Axis -" softkey to scroll the axes forward or backward.

- OR -

Press the "Axis selection" softkey.

The "Axis Direct Selection" window opens.

Select the required axis directly from those available in the drop-down list box.

6. Confirm the selection with "OK."

The values of the axis are displayed.

16.2.3 Service axis: Parameters

Axis parameters

Parameters	Meaning
Following error	The difference between the position setpoint and the actual position value of the active measuring system 1 or 2. Unit: mm, inches or degrees
System deviation	The difference between the position setpoint at the position controller input and the actual position value of the active measuring system 1 or 2. Unit: mm, inches or degrees
Contour deviation (axial)	The actual contour deviation is displayed with this value (variations of the following error caused by equalization operations on the speed controller due to load changes). The contour deviation results from the difference between an actual position pre-calculated from the position setpoint and the actual position value of active measuring system 1 or 2. Unit: mm, inches or degrees
Servo gain factor (calculated)	The servo gain factor in the display is calculated by the NC according to the following equation: K_v - factor = $\frac{\text{Speed setpoint}}{\text{Following error}}$; Unit (for default setting): $\frac{[\text{m/min}]}{[\text{mm}]}$; Velocity setpoint = setpoint currently being output to the axis/spindle.
Active measuring system	Here, it is displayed whether measuring system 1 or 2 is active.

Parameters	Meaning
Actual position value measuring system 1 Actual position value measuring system 2	The actual position of the axis measured via measuring system 1/2. The position is displayed in the machine coordinate system (no zero offsets or tool offsets taken into account). Unit: mm, inches or degrees
Position setpoint	Specified position transferred from the interpolator to the position control Unit: mm, inches or degrees
Absolute compensation value measuring system 1 Absolute compensation value measuring system 2	Display of the absolute compensation value for measuring system 1 or 2. The compensation value consists of the sum of backlash and leadscrew error compensation for the actual axis position. Unit: mm, inches or degrees
Compensation, sag + temperature	Display of the compensation value calculated for the current axis position based on the total of the sag and temperature compensations. Unit: mm, inches or degrees
Actual speed value, active encoder	The pulses supplied by the encoder are evaluated by the NC and displayed. Unit: % 100% means maximum speed.
Speed setpoint, drive	Speed setpoint transferred to the drive (= speed setpoint from position controller and feedforward control) Unit: % 100% means maximum speed setpoint.
Programmed spindle speed setpoint	Speed setpoint programmed by the user. Unit: rpm For example: Input: S1000; display: 1000 rpm Display applies to spindles only.
Spindle speed setpoint current	Current active speed setpoint with correct sign, including calculated compensation value and any active speed limitation (specified by setting or machine data). Unit: rpm Display applies to spindles only.
Position offset to the leading axis / spindle actual value	The currently valid position offset value is displayed here (relative to the actual value) if a position offset (angular offset between the following and leading spindle) has been programmed within the synchronous spindle functionality. Unit: mm, inches, degrees
Position offset to the leading axis / spindle setpoint	The currently valid position offset value is displayed here (relative to the setpoint) if a position offset (angular offset between the following and leading spindle) has been programmed within the synchronous spindle functionality. Unit: mm, inches, degrees
Override	The effective correction factor of the feed or spindle correction switch is displayed. Unit: %
Current gear stage	Display of the current actual gear stage. With axes, this is only displayed if a spindle is assigned to the axis. The display corresponds to the NC/PLC interface signal: DB31, ... DBX16.0-2 (actual gear stage)
Parameter set (axis)	Displays which of the six parameter sets of the position controller is active.

Parameters	Meaning
Controller mode	Display of the current controller state: • Position control • Speed control • Hold • Parking • Follow-up • Braking
Feedforward control mode	Indicates whether and if so, which mode of the dynamic feedforward control for the axis is active: • Inactive • Velocity The velocity-dependent speed feedforward control is active. • Torque The acceleration-dependent torque feedforward control is active (in combination with the speed feedforward control)
"Referenced" state	Status display for reference point approach (axis): • Curr. MS need not be ref.ed (active measuring system does not require referencing) • Curr. meas. system ref'd • Curr. meas. syst. m. be ref (active measuring system requires referencing) The display depends on the settings in the machine data: • MD34110 $MA_REFP_CYCLE_NR • MD20700 $MC_REFP_NC_START_LOCK The display corresponds to the NC/PLC interface signal: DB31, ... DBX60.4 and 60.5 (referenced/synchronized 1 or 2)

Parameters	Meaning
QEC state	Indicates whether and if so, which method of the quadrant error compensation (QEC) is active for the axis: • Inactive • Neural QEC learning active • Conventional QEC active • Conventional QEC w. adapt. comp. value act. (conventional QEC with adaptation of the compensation value active) • Neural QEC active • Neural QEC w. ad. meas. time val. act. (neural QEC active with adaptation of the measuring time active) • Neural QEC w. ad. dec. time comp. val. act. • (neural QEC with adaptation of decay time of compensation value active) • Neural QEC w. ad. meas. time + dec. time comp. val. act. (neural QEC active w. adapt. of measuring time and decay time of compensation value active)
"Travel to fixed stop" state	Indicates whether or not the axis has fulfilled the conditions for "Fixed stop reached" when the "Travel to fixed stop" function is active (IS DB31, ... DBX62.5): • Normal control ("Travel to fixed stop" function not activated) • Fixed stop reached • Failed
Torque limitation value	Indicates the value programmed via FXST[x] or SD43510 $SA_FIXED_STOP_TORQUE or the value defined via MD37010 $MA_FIXED_STOP_TORQUE_DEF for the clamping torque for "Travel to fixed stop". Unit: % of maximum torque

References

Function Manual Basic Functions:

- Various NC/PLC interface signals and functions (A2)
- Travel to fixed stop (F1)
- Velocities, Setpoint/Actual Value Systems, Closed-Loop Control (G2)
- Reference point approach (R1)

Function Manual Expansion Functions:

- Compensations (K3)
- Synchronous Spindles (S3)

16.2.4 Service drive

Display drive and motor data

The "Service Drive" window displays important information about the status of the motors and drive modules, such as motor temperature and DC-link voltage.

Procedure

1. Select the "Diagnostics" operating area.

2. Press the menu forward key.
   A switch is made to a new softkey bar.

3. Press the "Axis diagnostics" softkey.
   The "Service Overview" window opens.

4. Press the "Service drive" softkey.
   The "Service Drive" window opens.

5. Press the "Drive +" or "Drive -" softkey to scroll forward or backward.

   - OR -

   Press the "Drive selection" softkey.
   The "Drive Direct Selection:" window opens.

   Select the desired drive directly from the selection list.

6. Confirm the selection with "OK."
   The drive data is displayed.

16.2.5 Service drive: Parameters

Overview

The individual status displays, warnings, messages, etc. that are displayed in the "Service Drive" window are explained in the following.

Further information about the interface signals can be found in the following documentation: Function Manual, Basic Functions (A2, Z1)

Further information about the drive parameters can be found in the following documentation:
List Manual, SINAMICS S120/S150 (Servo)

PLC pulse enable

The display, whether the pulse enable from the PLC is available for the drive corresponds to the interface signal:
DB31, ... DBX21.7 "Pulse enable".

Status	Meaning	Display
1	Pulse enable for this drive is activated by the PLC.	Yes
0	The pulses for the drive module are disabled from the PLC.	No

Speed controller enable NC

The display, whether the speed controller enable from the NC is available for the drive corresponds to the interface signal:
DB31, ... DBX61.6 "Speed controller active".

Status	Meaning	Display
1	Speed controller enable from the NC present.	Yes
0	Speed controller enable from the NC not present.	No

Rampup function generator quick stop

The status display for the ramp-function generator quick stop corresponds to the interface signal:
DB31, ... DBX92.1 "Ramp-function generator disable active".

Status	Meaning	Display
1	Ramp-up function generator quick stop is active. The drive is stopped without a ramp function with speed setpoint = 0 and without pulse suppression.	Yes
0	Ramp-up function generator quick stop is not active for the drive.	No

Pulses enabled

The message whether the pulses have been enabled for the drive corresponds to the interface signal:
DB31, ... DBX93.7 "Pulses enabled".

Status	Meaning	Display
1	The drive module pulses are enabled. The axis/spindle can now be traversed.	Yes
0	The drive module pulses are suppressed. The axis/spindle can therefore not be traversed.	No

Drive ready

The display of the current status of the selected drive corresponds to the interface signal:
DB31, ... DBX93.5 "Drive ready".

Status	Meaning	Display
1	The drive is ready.	Yes
0	The drive is not ready.	No

Ramp-up phase

The display of the current ramp-up phase of the selected drive corresponds to the drive parameter:
r0002 "Drive operating display".

Number of faulty signs-of-life

Display of communications errors detected in hardware between NC and drive.

Note

If the display shows a value other than "0", please contact your Siemens regional office!

SC1 drive alarm message

Displays (yes/no) whether messages of status class 1 are active. Status class 1 messages are alarms with the following properties:

- They lead to internal responses (e.g. regenerative braking, immediate pulse suppression)
- They are modal.

This is a group message. For details on the actually pending drive alarms, please refer to the "Drive System Diagnostics" window, see Service drive.

DC-link voltage, smoothed

The display of the smoothed actual value of the DC-link voltage of the selected drive corresponds to the drive parameter:
r0026 "DC-link voltage smoothed".

Unit: Volts

Speed setpoint, smoothed

The display of the smoothed speed setpoint - measured according to the setpoint limitation for the P component of the speed controller - corresponds to the drive parameter:
r1438 "Speed controller speed setpoint".

Unit: rpm

Actual speed value

The display of the smoothed actual value of the motor speed corresponds to the drive parameter:
r0021 "Actual speed value smoothed".

Unit: rpm

Actual current value, smoothed

The display of the smoothed actual current value corresponds to the drive parameter:
r0078[1] "Actual current value, torque-generating".

Unit: A

Motor temperature

The display of the current temperature in the motor corresponds to the drive parameter:
r0035 "Motor temperature"
Unit: °C

Integrator disabling

The display as to whether the integrator of the speed controller is active, corresponds to the interface signal:
DB31, ... DBX93.6 "n-controller integrator disabled".

Status	Meaning	Display
1	The requested shutdown of the speed controller integrator is active in the drive. The speed controller has been switched over from the PI to P control response.	Yes
0	The integrator of the speed controller is enabled. The speed controller functions as a PI controller.	No

Parking axis

Displays (yes/no) whether it is a parking axis/spindle.

Note

With parking axes/spindles, all encoder-specific monitoring and evaluation functions are switched off. This allows the encoder to be withdrawn without initiating an alarm.

Specified drive data set

The display (default: DDS0) of which of the eight drive parameter sets is to be activated by the PLC corresponds to the interface signal:
DB31, ... DBX21.0 to 21.2 "Drive parameter set selection A, B, C".

More detailed information on working with the drive and motor data sets can be found in:
Commissioning Manual, IBN CNC: NCK, PLC, Drive

Actual drive data set

The display (default: DDS0) of which of the eight drive parameter sets is currently active corresponds to the interface signal:
DB31, ... DBX93.0 to 93.2 "Active drive parameter set A, B, C".

Specified motor data set

The display (MDS0...3) of which motor data set is to be activated by the PLC corresponds to the interface signal:
DB31, ... DBX21.3 to 21.4 "Motor selection A, B".

The following assignment applies:

Motor data set	Coding	
MDS0	0	0
MDS1	0	1
MDS2	1	0
MDS3	1	1

Actual motor data set

The display (MDS0...3) of which motor data set is currently active corresponds to the interface signal:
DB31, ... DBX93.3 to 93.4 "Active motor A, B".

Operating mode

The display of the control type of a drive corresponds to the drive parameter:
p1300[0…n] "Open-loop/closed-loop control mode".

Depending on "n", the following "values" are displayed:

n	Display
20	Speed control (without encoder)
21	Speed control (with encoder)
23	Torque control (with encoder)

Position actual value measuring system 1/2

The actual position of the axis as measured via measuring system 1/2. The position is displayed in the machine coordinate system (no zero offsets or tool offsets included).

Unit: mm, inches or degrees

Heat sink temperature

The display of whether the heat sink temperature is OK corresponds to the interface signal: DB31, ... DBX94.1 "Heat sink temperature prewarning".

Status	Meaning	Display
1	The drive signals a "Heat sink temperature prewarning" to the PLC.	Overtemperature
0	The drive module heat sink temperature pre-warning has not responded.	OK

Motor temperature

The display of whether the motor temperature is OK corresponds to the interface signal: DB31, ... DBX94.0 "Motor temperature prewarning".

Status	Meaning	Display
1	The motor temperature has exceeded the warning threshold configured in the drive.	Overtemperature
0	The motor temperature is below the warning threshold.	OK

Ramp-up function completed

The status display of the drive as to whether the ramp-up has been completed corresponds to the interface signal:
DB31, ... DBX94.2 "Ramp-up completed".

Status	Meaning	Display
1	The actual speed value has reached the speed tolerance band specified via p2164 after a new speed setpoint specification and has not left the band for the duration of p2166.	Yes
0	The ramp-up procedure is still active after the speed setpoint has been changed.	No

Torque lower than threshold setting

The status display of the drive as to whether the threshold torque has been undershot corresponds to the interface signal:
DB31, ... DBX94.3 "$|M_d| < M_{dx}$".

Status	Meaning	Display
1	The current torque utilization lies below the torque utilization threshold set in p2194. The drive signals the PLC that the torque setpoint $|M_d|$ does not exceed the threshold torque M_{dx}.	Yes
0	The torque setpoint $|M_d|$ is larger than the threshold torque M_{dx}. This signal can be used to determine whether the motor is overloaded.	No

Speed lower than minimum setting

The status display of the drive as to whether the minimum speed has been undershot corresponds to the interface signal:
DB31, ... DBX94.4 "$|n_{act}| < n_{min}$".

Status	Meaning	Display
1	The actual speed value $|n_{act}|$ is less than the threshold minimum speed n_{min} set in p2161.	Yes
0	The actual speed value is greater than the threshold minimum speed.	No

Speed lower than threshold setting

The status display of the drive as to whether the threshold speed has been undershot corresponds to the interface signal:
DB31, ... DBX94.5 "$|n_{act}| < n_x$".

Status	Meaning	Display
1	The actual speed value $|n_{act}|$ is less than the threshold speed n_x set in p2155.	Yes
0	The actual speed value is greater than the set threshold speed.	No

Actual speed = set speed

The status display of the drive as to whether the actual speed value matches the speed setpoint corresponds to the interface signal:
DB31, ... DBX94.6 "$|n_{act}| < n_{set}$".

Status	Meaning	Display
1	The speed deviation between the setpoint and actual value is within the tolerance specified in p2163.	Yes
0	The speed deviation between setpoint and actual value is outside the specified tolerance.	No

Diagnostics for alarms

This information is also provided as a diagnostic tool for diagnosing the causes of alarms such as:

- Drive fault:
  ⇒ **SC1 drive alarm message** is set.
  ⇒ Check **specified drive data set**, **specified motor data set**, **DC-link voltage**.
- Alarm 25040 "Standstill monitoring",
  Alarm 25050 "Contour monitoring",
  Alarm 25060 "Speed setpoint limitation",
  Alarm 25080 "Positioning monitoring"
  ⇒ the drive enable may be missing (**PLC pulse enable** not present); this results in the display **Pulses enabled** = No.
- **Motor temperature** = exceeded
  ⇒ check the current motor temperature.

For information on the behavior of the NC controller in response to individual alarms and the remedy, please refer to:
References:
Diagnostic Manual

See also

Displaying drive states (Page 301)

16.3 System utilization

For the NC areas you can display the system resources (utilization display) currently being used:

- Runtime for the position controller, interpolator and pre-processing are displayed
- Time required for synchronized actions

Machine manufacturer

Please observe the machine manufacturer's data for the display of the time required for synchronized actions.

- Position controller and interpolator NC load
- Interpolator buffer level

Procedure

1. Select the "Diagnostics" operating area.

2. Press the menu forward key.
   New horizontal softkeys are displayed.

3. Press the "System utilization" softkey.
   The "System Utilization" window appears.
   You can track the dynamic utilization display.

4. Press the "Stop" softkey to stop the display update.

5. Press the "Start" softkey to refresh the values.

16.4 Displaying the time required for synchronized actions

General machine data

If you wish to display the utilization evaluation across synchronized actions in the operating area "Diagnostics", "System utilization", then set the general machine data as follows:

MD11510_$MN_IPO_MAX_LOAD	Maximum permissible IPO load
> 0	The time required for synchronized actions is activated and the line "Time required for synchronized actions" is displayed with the actual values.
= 0	Display deactivated (default value)

16.5 Creating screenshots

You can create screenshots of the current user interface.

Each screenshot is saved as a file and stored in the following folder:

/**user**/sinumerik/hmi/log/screenshot

Procedure

Ctrl + P Press the <Ctrl+P> key combination.

A screenshot of the current user interface is created in .png format.

The file names assigned by the system run in ascending order from "SCR_SAVE_0001.png" to "SCR_SAVE_9999". You can create up to 9,999 screenshots.

Copy file

1. Select the "Start-up" operating area.

2. Press the "System data" softkey and open the specified folder.

As you cannot open screenshots in SINUMERIK Operate, you must copy the files to a Windows PC either via "WinSCP" or via a USB-FlashDrive.

You can open the files using a graphics program, e.g. "Office Picture Manager".

16.6 Machine identity

You can store important information about the machine electronically that until now has only been available on paper for the end user notification administration (EUNA). This information can be viewed and/or transferred directly to EUNA (End User Notification Administration) via the set-up drives during servicing.

You can store the following data for each machine:

- Machine type
- Machine number
- Manufacturer information
- Dealer information
- End user information

You enter the machine information and address information in the "machine identity" window. The information can be either manually entered or using selection files.

Machine information

Entries	Meaning
Machine No.	The unique machine number (serial number of the CompactFlash card) is displayed in the header. This number serves as information only and cannot be changed.
Machine name	The manufacturer assigns a unique machine number in this field which is stored in machine data MD17400 $MN_OEM_GLOBAL_INFO. Note: The machine name is a mandatory field. No data can be stored until this field is completed.
Machine type	Machine type.

Address information

Under Addresses you can enter the following data for the manufacturer/manufacturer's regional office, dealer and end customer:

- Customer number
- Manufacturer name and, if required, Branch name / Dealer name / End user name
- Street, Postal code/ZIP code, Location, Country (can be selected from a selection list), Region/State
- Address of contact: Name, Phone, Fax, E-mail, URL

16.6.1 Entering machine-specific information

Preconditions

You must have the following access rights to be able to enter or change machine-specific information.

Access level 1 (manufacturer)

Access level 2 (service)

Access level 3 (user)

Procedure

1. Select the "Diagnostics" operating area.

2. Press the "Version" softkey.
   It takes some time to call the version display. While the version data is being determined a progress message box and the appropriate text are displayed in the dialog line.

3. Press the "Logbook" and "Change" softkeys.
   The "Machine Identity" window opens.

4. Press the softkey "Manufacturer" if you want to acquire and store manufacturer-specific data.
   If you press the "Manufacturer" softkey again, it changes to "Manufacturer branch".
   - OR / AND -

   Press the softkey "Manufacturer branch" if you want to acquire and store address data of the manufacturer branch.
   Pressing the softkey once again changes it back to "Manufacturer".
   - OR / AND -

   Press the softkey "Dealer" if you want to acquire and store dealer-specific data.
   - OR / AND -

Press the softkey "End user" if you want to acquire and store user-specific data.

5. Enter the address data in the following text fields.

- OR -

If selection files exist, all unique information will automatically be set to valid for the system when you press the "OK" softkey. The entries are stored in the operating software.

See also

1. Documenting startup (Page 268)
2. Defining start-up (Page 268)

Making a logbook entry (Page 269)

16.6.2 Creating a selection file

Using the selection files, you can prepare the machine information and address information and transfer it into the controller. This means that it does not have to be manually entered.

If there is only one entry in the selection file, then the controller uses this entry as default value.

Selection files

You can store the following selection files in the controller:

- "dealer.xml" for dealer data
- "ma_types.xml" for machine types
- "oem.xml" for manufacturer data
- "oemsubs.xml" for manufacturer data of a regional office
- "user.xml" for end user data

Templates

Templates for selection files are available under the directory /HMI-data/templates/examples/machine identity.

In future, EUNA data will also be available, which you can store in the controller. This therefore ensures that the address information is clear.

Procedure

1. Select the "Start-up" operating area.

2. Press the "System data" softkey.

3. Copy the files from the folder /HMI-data/templates/examples/machine identity to a data carrier.
4. Copy the files to your PC so that you can edit them more easily there.
5. After editing, copy the files to a data carrier so that these can then be transferred to the controller.

6. Insert the copies into the folder /HMI-data/templates/manufacturer/machine identity.

Note

- If you have only specified one address or one machine type, the data is automatically entered in the input fields when the window opens.
- If you have entered several addresses or machine types, they are displayed in drop-down list boxes. When you select a list, the data stored for that address is automatically entered in the input fields.

Entering dealer data

You can acquire the address data of any number of dealers in file "dealer.xml". If you wish to enter additional dealers, for each dealer, copy the area <Dealer> to <Dealer>.

```
<?xml version="1.0" encoding="utf-8" ?>
<Addresses>
   <Dealer>
     <Customer-Id></Customer-Id>
     <Name></Name>
     <Street></Street>
     <ZIP code></ZIP code>
     <Location></Location>
     <Country></Country>
     <State></State>
     <Contact></Contact>
     <Phone></Phone>
     <Fax></Fax>
     <E-mail></E-mail>
     <URL></URL>
   </Dealer>
</Addresses>
```

You can list the address data of any number of manufacturers in the "oem.xml" file. If you wish to enter additional manufacturers (OEMS), for each dealer, copy the area <Manufacturer> to </Manufacturer>.

You can list the address data of any number of OEM regional offices in the "oemsubs.xml" file. If you wish to enter additional regional offices, copy the area <Manufacturer-Subsidiary> to </Manufacturer-Subsidiary>.

You can list the address data of any number of users in the "user.xml" file. If you wish to enter additional users, copy the area <User> to </User>.

Example of file "ma_types.xml"

You can acquire the available machine types in file "ma_types.xml".

```
<?xml version="1.0" encoding="utf-8" ?>
<Machinetypes>
   <Type>LC 80</Type>
   <Type>LC 82</Type>
   <Type>LC 120</Type>
   <Type>LC 122</Type>
   <Type>LC 150</Type
</Machinetypes>
```

16.6.3 Reading in a selection file

You can directly read-in your selection files into the controller. Depending on the configuration, files can be selected and imported from a local drive, network drive or USB. The data are then automatically copied into the following folder: /**oem**/sinumerik/hmi/template/identity.

Selection files

This procedure applies for the following selection files:

File	Information
ma_types.xml	Machine types
dealer.xml	Dealer's data
oem.xml	Manufacturer's data
oemsubs.xml	Manufacturer's data of a regional office
user.xml	End customer data

Additional information on the selection files is provided in Chapter:

Creating a selection file (Page 260)

Procedure

1. Select the "Diagnostics" operating area.

2. Press the "Version" softkey.
   It takes some time to call the version display. While the version data is being determined a progress message box and the appropriate text are displayed in the dialog line.

3 Press the "Logbook" and "Change" softkeys.

4. Press the "Import data" softkey.
   The "Read-in selection files: Select File(s)" window opens.
5. Select the appropriate drive and the required file(s).

6. Press the "OK" softkey, the file is automatically copied to the correct location in the system.

Note

Effectiveness of the selection file

A file selection (e.g. oem.xml) only becomes effective if you have still not saved any files in this area (e.g. manufacturer). In spite of this, if you download a new selection file, delete all of the fields of the area that have been completed and confirm the procedure using the "OK" softkey.

16.6.4 Save information

All the machine-specific information of the controller is combined in a configuration via the user interface. You can save machine-specific information on the drives that have been set-up.

Procedure

1. Select the "Diagnostics" operating area.

2. Press the "Version" softkey.
   It takes some time to call the version display. While the version data is being determined a progress message box and the appropriate text are displayed in the dialog line.

3. Press the "Save" softkey.
   The "Save version information: select archive" window opens. The following storage locations are offered depending on the configuration:
   - Local drive
   - Network drives
   - USB
   - Version data (archive: Data tree in the "HMI data" directory)

4. Then press the "New directory" softkey if you wish to create your own directory.

5. Press the "OK" softkey. The directory is created.

6. Press the "OK" softkey again to confirm the storage location.

   The "Save version information: name" window opens. The following options are available:
   - In the "Name:" text field, The file name is pre-assigned with <Machine name/no.>+<CF-card number>. "_config.xml" or "_version.txt" is automatically attached to the file names.
   - In text field "Comment", you can add a comment, which is stored with the configuration data.

Select the following via a checkbox:

- Version data (.TXT): Output of pure version data in text format.
- Configuration data (.XML): Output of configuration data in XML format. The configuration file contains the data you entered under Machine identity, the license requirements, the version information and the logbook entries.

7. Press the "OK" softkey to start the data transfer.

16.6.5 Adding hardware components

Most of the hardware components supplied by Siemens are already electronically acquired. You can add further hardware components.

You can view and supplement the hardware components in the version screen at the user interface.

All of the hardware components are listed in the version display and in the configuration data.

Precondition

You require access level 2 (service) to add more hardware components.

Entering additional components

If new hardware components are added, they must be assigned to the appropriate categories. The "Select component" drop-down list box offers the following categories in the "Add HW Comp." window:

Category
NCU/PLC
Operator Panel
PLC-peripheral devices
Drive/Motor
Cable
Accessories/Miscellaneous

You record the following data in the "Enter Additional Components (Configuration Data)" window.

Entries	Meaning
Name	Hardware designation
Version	Version of the program

Entries	Meaning
Order No.[MLFB]	Order number
Serial number	Serial number
Number	Number of components

Procedure

1. Select the "Diagnostics" operating area.

2. Press the "Version" softkey.

   It takes some time to call the version display. While the version data is being determined a progress message box and the appropriate text are displayed in the dialog line.

3. Select the "Hardware" area and press the "Details" softkey. The "Version Data / Hardware" window opens.

   The "Add HW comp." softkey appears.

4. Press the "Add HW comp." softkey.

   The "Select component type" drop-down list box opens.

5. Select a category under which you would like to store the hardware information.

   The "Enter Additional Hardware Components" input window opens.

6. Enter additional hardware components via the keyboard.

   - OR -

   If you are using a CSV file (CSV = Comma Separated Values), for example a EUNA parts list, you can also read in the data.

   Select the storage location where the CSV file is located.
   Select the file and press "OK".

   The data is transferred from the CSV file into the table. It is read-in according to the CSV format of the EUNA parts list. For each component, quantity, MLFB, name and serial number are entered. The version is not saved and is not transferred.

   Example:

   QUANTITY;MLFB;Z_OPTION;SERIAL

   12;6AV7812-0BB11-2AC0;;

   1;6FC52030AB110AA2;;T-0815

7. Press the "OK" softkey.

   The data is written to the "versions.xml" configuration file and is therefore electronically acquired.

   All hardware components are displayed in the "Version Data / Hardware" window.

   The manually entered components are assigned a "+", e.g. Cable+.

16.6.6 Configuration data

The machine-specific information is stored in the configuration data. This file saved in the XML format provides the basis for further processing in EUNA.

- The data can be read by remote diagnostics.
- The data can also be transferred directly to EUNA, e.g. via network or USB FlashDrive.

Configuration data

The configuration data includes:

- Machine-specific data that is stored in the "Machine identity" dialog box, see Machine identity (Page 258)
- Hardware/software versions that are stored in the "Versions" dialog box, see Adding hardware components (Page 265)
- Options requiring licenses, which are stored in the "Licensing" dialog box, see Licensing (Page 23)
- Logbook, whose entries are stored in the "Logbook" dialog box, see Logbook (Page 267)

Storage path

Depending on how the drives have been configured, the configuration data can be stored in the available directories.

16.7 Logbook

The logbook provides an electronic machine history.

The time and date of commissioning is recorded in the logbook, and if the machine is serviced, this can also be logged electronically. This helps to optimize the service.

Stored entries cannot be changed or deleted.

16.7.1 1. Documenting startup

Precondition

As a minimum, the machine name/No., the customer No. and the country where the manufacturer is located must be entered into the machine identity.

Procedure

1. The machine-specific information data are entered.
2. Start-up (commission) the machine.

3. Press the "1st startup completed" softkey.
   The "1.SETUP" entry is displayed in the "Machine logbook" window together with the time and date.

See also

Entering machine-specific information (Page 259)

16.7.2 2. Defining start-up

Precondition

As a minimum, the country of the end customer must be entered into the machine identity.

Procedure

The machine-specific information data are entered.

2. Start-up (commission) the machine.

3. Press the "2nd startup completed" softkey.
   The "2.SETUP" entry is displayed in the "Machine logbook" window together with the time and date.

See also

Entering machine-specific information (Page 259)

16.7.3 Making a logbook entry

Using the "New logbook entry" window to make a new entry into the logbook.

Enter your name, company and department and a brief description of the measure taken or a description of the fault.

Note

If you wish to make line breaks in the "fault diagnostics/measure" field, use the key combination <ALT> + <INPUT>.

The date and entry number are automatically added.

Sorting the entries

The logbook entries are displayed numbered in the "machine logbook" window.

More recent entries are always added at the top in the display.

Procedure

1. The logbook is opened.
2. Press the "New entry" softkey.
   The "New logbook entry" window opens.
3. Enter the required data and press the "OK" softkey.
   You return to the "Machine logbook" window and the entry is displayed below the machine identity data.

Note

Once you have stored an entry this can no longer be changed or deleted.

Searching for a logbook entry

You have the option for searching for specific entries using the search function.

1. The "Machine logbook" window is opened.
2. Press the "Search..." softkey and enter the desired term in the search form. You can make a search according to date/time, company name/department or according to fault diagnostics/measure.
   The cursor is positioned on the first entry that corresponds to the search term.
3. Press the "Continue search" softkey if the entry found is not the one that you are looking for.

Additional search option

Press the "Go to Beginning" softkey to start the search at the latest entry.

Press the "Go to End" softkey to start the search at the oldest entry.

16.8 Action log

16.8.1 Setting the action log

In the "Action Log Settings" window you specify whether the operating sequences are to be logged.

Here, you select which control actions should be logged, so that operator actions and sequences can be tracked and understood at a later date.

When the action log is active, you can display recorded traces in the system data using the following files:

- "actual_actionlog.com", actual action log report
- "actual_crashlog.com", crashlog backup

Data that can be logged

Logging on	Logging is activated or deactivated.
Alarm status change	Incoming and outgoing alarms are logged.
Keyboard actions	All actions on the operator panel front and on an external keyboard are logged.
Channel status change	NC/PLC states are logged via the information channel status. If this information can be obtained in a timely manner, in many cases these states can be used to verify the operation of the machine control panel.
Window switchover	The form and dialog names (assigned by the programmer) are logged each time a window is opened or closed.
Writing NCK/PLC data	The writing of NCK and PLC variables is logged.
File access	Copying to the NC is logged.
Function calls in the NCK (PI service)	Some program calls, for example, ASUB, are logged.

Curr. program status	Additional information for particular events is activated. For important alarms that require NC stop, NC start, or NC reset, actual values and the current block are recorded for example. The program ascertains which channel and which spindle are used for the additional information.
Write interval file	Settings for updating files: • "automatic": The action log saves the information to an internal buffer. If the buffer is full the entries are written to the CF card. The entries may be lost when the controller is switched off. • "after every event": All entries are backed up directly, this prevents data loss due to a power failure or similar. Notice: As CF cards only permit a limited number of write accesses, this setting is not recommended for normal operation. • "time-controlled": New entries are backed-up for a particular length of time. An additional input field appears in which you can specify a time in seconds.
Save log as file for alarm(s)	The alarm numbers for which a "crash log" is generated are specified. The alarms are entered separated by a comma.

Generating a crashlog file

The "actual_crashlog.com" is a backup file of the actual log when a critical event occurs (for example, emergency stop alarm).

The file is then no longer stored in the ring buffer of the action log and can no longer be overwritten with new entries.

The entries in the crash log file are only overwritten when yet another critical events occurs.

At the beginning, the file has no entries and is only written to after the following events:

- Interface signal DB19.DBX0.6 "Save teleprinter log" changes from 0 to 1.
- The alarm entered in the "Save log as file for alarm(s)" entry field is output.

Interface signal

DB19 (PLC → HMI)								
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
DBB00		Save action log						

Procedure

1. Select the "Start-up" operating area.

2. Press the "HMI", "Diagnostics", and "Action log" softkeys
   The "Action Log Settings" window opens.
3. Activate the "Logging on" checkbox to activate the action log.
4. Check the relevant checkbox if you want to acquire particular events in the action log.

See also

Displaying the log file (Page 272)

16.8.2 Displaying the log file

Loggable data that was logged when the action log function was active is displayed in the "Action Log File" window.

Log files

The actual data can be displayed using the following files:

- "actual_actionlog.com"
- "actual_crashlog.com"

Procedure

1. Select the "Start-up" operating area.

2. Press the "System data" softkey.
   The data tree is displayed.
   You will find the saved files in the HMI data folder under /logs/action log.

3. Select the desired com file and press the "Open" softkey or double-click the file.

4. Press the "Display new" softkey to update the display of events in the log (actual_actionlog.com).

   The entries made since the log file was called up are displayed.

16.8.3 Searching in the log files

You can search for specific events in the log.

Precondition

The relevant log file is open.

Procedure

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. Position the cursor in the "Direction" field and choose the search direction (forward, backward) with the <SELECT> key.

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

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

   Press the "Continue search" softkey to continue the search, as necessary.

   - OR -

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

Additional search option

1. Press the "Go to End" softkey to scroll to the end of a large log. You get to the oldest entry of the recording.

2. Press the "Go to Beginning" software to return quickly to the most recent log entry.

16.8.4 Storing a log

You can store the displayed log in any directory you select. It is stored as a binary file as well as ASCII file. You can ready an ASCII file with any editor.

The following logs are generated:

- action.com (binary file)
- action.log (ASCII file)
- crash.com (binary file)
- crash.log (ASCII file)

Precondition

The relevant log file is open.

Procedure

1. Press the "Save Log" softkey.
   The "Please Select the Target Directory" window opens in which you can select a storage location.

2. Press the "New Directory" softkey if you want to create a new folder in one of the listed directories.

3. Press the "OK" softkey.

Note

The "Save Log" softkey is only available for files that have not yet been saved.

16.8.5 Structure of a log file

Content of the log file

The following data are recorded for every logged event:

HMI version		NCK version	
System	Entry keyword		Date/time
	Entry text		
	DETAILS		

Entry		Description	
HMI and NCK version output			
System:			
	HMI	Keystrokes, window change	
	NCK	Write variables, PI services	
	MSG	Alarm entries	
	USR	Entries generated by the machine manufacturer for the user	
	ERR	Action log error, e.g. log file not found	
Entry keyword:			
	HMI_START	Entry of an HMI boot	
	HMI_EXIT	Entry of an HMI shutdown	
	PLC_CRASH	Entry of a PLC crash	
	KEY_PRESSED	Entry of a keystroke	
	KEY_HOLD	Entry of a key hold	
	KEY_RELEASED	Entry of a key released	
	ALARM_ON	Entry of an incoming alarm event	See below "Alarm display"
	ALARM_OFF	Entry of an alarm going event	
	ALARM_ACK	Entry of an alarm acknowledgement event	
	OPEN_WINDOW	Entry of a window opening	
	CHN_STATE_CHANGED	Entry of a channel status change	
	OPMODE_CHANGED	Entry of an operating mode change	
	TOOL_CHANGED	Entry of a tool change	
	OVERRIDE_CHANGED	Entry of override changes	
	DOM_CMD	Entry of a download to the NC	
	PI_CMD	Entry of a PI service	
	WRITE_VAR	Entry of a write to NCK/PLC variable	
	AREA_CHANGED	Entry of an area changeover	
	NC_CONNECTION	Entry of an coming/going NC connection	
	USER	User entry via the OEM interface	
	ACTIVATED	Action log was activated	
	DEACTIVATED	Action log was deactivated	
	INTERNAL	Internal action log entry	
Date/time		Date and time of the event For HMI_Start, PLC_Crash or date change since the last entry, the intermediate period between the entry keyword and date is designated with an "-".	
Entry text		Event data are written in plain text.	
DETAILS		If additional information regarding an entry is know, e.g. a recorded IPO trace.	

Example

```
NCK    WRITE_VAR                                        18.02.2009  09:40:12
       ncu1.local wrote variable: DB19.DBW24 = 0
HMI    KEY_PRESSED                                      18.02.2009  09:40:12
       Key up: "Return" (1000004/ 0)
HMI    HMI_START ----------------------------           18.02.2009  09:34:15
       HMI started.
```

Alarm display

```
MSG      ALARM                                                  Date/time
         No.       Deletion criterion   Text
         DETAILS
```

Entry		Description
MSG		
ALARM		Type of alarm: ALARM_ON, ALARM_OFF, ALARM_ACK
Date/time		Data and time of the event
No.		Alarm number
Deletion criterion:		Information as to how the alarm was acknowledged
	AUTOMATIC	Automatic acknowledgement
	POWER ON	Acknowledgment using PowerOn
	RESET	Acknowledgement using NCK reset
	NC START	Acknowledgement using NC start
	NC RESET	Acknowledgement using NC reset
	ALARM CANCEL	Acknowledgement using Alarm Cancel key
	RECALL	Acknowledgement using the Recall key
	HMI	Acknowledgment using HMI
	PLC	Acknowledge using PLC
Text		Display of the English alarm text
DETAILS		If additional information regarding an entry is known.

Example

```
MSG    ALARM_ON                                         20.02.2009   14:25:37
       8020   POWER ON   : Option 'activation of more than 1 channels' not
       set
       DETAILS:
       Mode: JOG Program: canceled Channel: interrupted
       Program-Level information:
```

```
Level Program running:                          Invoc        Offset
1     /_N_MPF0                                  0            0
```

16.8.6 Advanced settings

You define the size of the log file of the action log in the "actlog.ini" configuration file.

Procedure

1. You can copy a sample configuration file "actlog.ini" from the following directory: /siemens/sinumerik/hmi/template/cfg.
2. Save or create the file in the /oem/sinumerik/hmi/cfg or /user/sinumerik/hmi/cfg directory.
3. Open the file and after "; ActionLogSize=", enter the file size (in bytes).

"actlog.ini" configuration file

```
Template for the configuration of Action Log
;
; To activate the settings remove the
; commentary ';' at the beginning of the line
[ActionLogSettings]
;To change the path of the internal action log file use the following setting
;ActionLogPath=/user/sinumerik/hmi/ac_log/action.com
;To change the size of the internal action log file use the following setting
;ActionLogSize=5000000
;To change the path of the internal crash log file use the following setting
;CrashLogPath=/user/sinumerik/hmi/ac_log/crash.com
```

16.9 HMI trace

Creating an HMI trace

The "HMI trace" function is available for extended diagnostics of the operating software. The prerequisite is at least access level 3 (user).

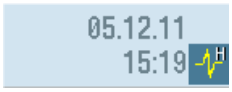
Procedure to create an HMI trace file:

1. An expert of the Service & Support Center provides a sltrc_keybitset.ini file. Copy the sltrc_keybitset.ini file to a USB memory medium and load the file on the controller or operator panel.
2. In the operating area, select "Start-up" → "HMI" → "Diagnostics >" → "HMI trace".
3. Select the INI file on the USB memory medium with the "Load configuration" softkey.
4. Start the trace by activating the checkbox or from any place on the user interface with the following key combination:

   <Alt> + <T> on the operator panel

   <Alt> + <Shift> + <T> on an external keyboard

   The following icon is displayed at the top right in the header to show that a trace is active:

5. On the user interface, repeat the operating sequence whose cause is to be clarified.
6. Stop the trace by deactivating the checkbox or from any place on the user interface with the following key combination:

   <Ctrl> + <T> on the operator panel

   <Ctrl> + <Shift> + <T> on an external keyboard
7. A sltrc.out output file is generated which you can copy to the storage medium with the "Export data" softkey.
8. Send the sltrc.out file for analysis back to the Service & Support Center.

Note

On completion of the analysis, it is recommended to delete all files under the following path: ../user/sinumerik/hmi/log/sltrc

NOTICE
"Extended" softkey The other options in this dialog support suitably qualified service engineers in the analysis of the system and evaluation of the HMI trace.

16.10 PROFIBUS diagnosis

Display the PROFIBUS status for diagnostic purposes during the configuration or when errors occur. This diagnostics window is only intended for information purposes. You cannot modify them.

PROFIBUS connections

- DP1 X126
- DP2 X136
- DP integrated

Display	Meaning/information
Status	
Configuration ok	Status of the configuration Green: DP master has ramped up Red: Incorrect response / no communication
Bus status	POWER ON: Status after the controller is switched on. OFFLINE: Basic initialization has been performed. STOP: Start in accordance with the hardware configuration (SDB). CLEAR: PROFIBUS slaves have been parameterized and configured in accordance with the hardware configuration (SDB) and taken into the cyclic data exchange with zero output data. OPERATE: Cyclic data exchange with the PROFIBUS slaves running. ERROR: A fatal error had been detected (e.g. invalid or faulty SDB)
Bus configuration	
S7 Subnet ID	S7 Subnet ID of the PROFIBUS subnet
Baudrate in MBd	Transmission rate
Cycle time in msec	Configured bus-cycle time; also defines the position controller cycle at the same time
Sync. Component (TDX) in msec	Configured period for the cyclic data exchange within a PROFIBUS DP cycle
PROFIBUS diagnostics/slaves	
Slave no. (DP address)	Configured DP address of the DP slave
Assignment	Information whether the DP slave is assigned to the NC or to the PLC NC: e.g. one or more drives controlled by the NC. PLC: e.g. I/O peripherals or an axis controlled by the PLC. NC/PLC (for DP integrated)
active on the bus	Information whether the DP slave is identified on the bus Green: DP slave has been detected on the PROFIBUS DP and the data exchange is working error-free with the assigned component (NC and/or PLC) Red: Incorrect response / no communication

Display	Meaning/information
Synchr. with NC	Information whether the DP slave is running synchronously to NC on the bus. Green: DP slave runs synchronously to NC on the PROFIBUS DP, i.e. there is an isochronous data exchange. Red: Incorrect response / no communication Gray: DP slave is not assigned to the NC, but to the PLC
Number of slots	Number of configured slots within the DP slave

References

Further information about the configuration of the properties of the network interface for PROFIBUS can be found in the following:

CNC Commissioning Manual: NCK, PLC, Drives, SINUMERIK 840D sl, SINAMICS S120

Procedure

1. Select the "Diagnostics" operating area.

2. Press the menu forward key and the "Bus TCP/IP" softkey.
   The "PROFIBUS Diagnostics" window is opened.

...

3. If several PROFIBUS connections have been configured, press the "Bus -" or "Bus +" softkey to select the desired configuration.

- OR -

Press the "Select bus" softkey and in the list that is displayed, select the required configuration.

Press the "OK" softkey.

16.10.1 Displaying details for DP slaves

Further information about the slots of a selected DP slave is displayed here.

Display	Meaning/information
Slave	
Slave no.	The DP slaves selected in the PROFIBUS Diagnostics / Slaves pane with information on the NC or PLC assignment,
Slots	
No.	Slot number within the DP slave
I/O address	I/O address in the I/O address space of the PLC assigned to this slot. For NC axes, the setpoint and the actual value must always be configured on the same I/O address.
Logical drive no.	Drive number specified in the NC machine date for the axis.
Length (bytes)	Length of the I/O area reserved for the slot in the STEP7 I/O address space.
Type	Specification, whether the slot is input, output or diagnostic slot. If the slot is assigned to an NC axis, then the output is always denoted as setpoint value and the input always as actual value.
Machine axis	Display of the name defined in the machine data for this slot. If the slot is not assigned to any NC axis, <No NC-axis> is shown.
Message frame type	If a telegram type has not been assigned in the NC machine data, the telegram type is not occupied (-).
State	Current state of slot. Displayed only for NC axes. Green: Slot used by NC, communication active. Red: Slot used by NC, communication currently not active. Gray: No NC axis.

Procedure

1. Select the "Diagnostics" operating area.

2. Press the menu forward key and the "Bus TCP/IP" softkey.
   The "PROFIBUS Diagnostics" window is opened.

3. Select the PROFIBUS configuration for which you want to display details.

4. Press the "Details" softkey.
   The "PROFIBUS Diagnostics ... - Details" window is opened.

16.11 Station-related network diagnostics

Using the station-related network diagnostics, you have the possibility of identifying faulty or incorrectly parameterized components or those components that have not been connected.

You obtain an overview of all of the components belonging to the system network:

- NCU
- PCU
- TCU
- MCP
- EKS

If components are either faulty or absent (or unavailable), they will be marked as such in this overview.

Error analysis

You have the option of initiating a fault analysis for the components involved. You obtain the result of a such a diagnostics in the form of a fault message. The possible fault states and causes are described in this fault message together with how to resolve the fault.

16.11.1 Displaying network adapters

The actual network adapters (system network X120, company network X130 or system network ETH2 and company network ETH1) and their availability are displayed in a tree-like structure in the "TCP/IP diagnostics" window.

Displaying the components

The following components are displayed in the window:

- The control is displayed at the topmost level.
- System network (X120 / ETH2) with configured operator stations with IP address
  - Operator panels with IP address
  - Machine control panels
  - EKS
- Company network (X130 / ETH1) with
  - Operator panels with IP address
  - Machine control panels
  - EKS

Components that cannot be accessed

If a component cannot be accessed, then it is marked using this symbol.

Input rights

Operator panels, which have input rights, have a green background.

Detailed display

You have the option to display the following information about a selected component.

TCU

- IP address
- SW version
- MCP index from the configuration
- TCU index from the configuration
- DNS name
- Resolution

MCP

- IP address
- DNS name
- MCP index from the configuration
- MCP index requested from HMI
- MCP index requested from PLC

References

For additional information about network configuration, please refer to the following documentation:

Commissioning Manual, IBN CNC: NCK, PLC, drive

Procedure

1. Select the "Diagnostics" operating area.

2. Press the menu forward key and the "Bus TCP/IP" softkey.

3. Press the "TCP/IP diagnostics" softkey.
   The "TCP/IP Diagnostics" window is opened and displays the current availability of the network connections.

4. Position the cursor on the component for which you wish to display the detailed information.

5. Press the "Details" softkey to display all available parameters of the configured network connections.

6. Press the "Details" softkey to hide the detailed display.

7. Press the "Return" softkey in order to exit the "TCP/IP diagnostics" window and return to the "PROFIBUS diagnostics" window.

16.11.2 Error analysis

16.11.2.1 Performing error diagnostics

Precondition

Error analysis only functions for a PCU.

Procedure

1. The "TCP/IP Diagnostics" window opens.
2. Position the cursor on the component that is marked as having an error (NCU).

3. Press the "Error analysis" softkey.

The corresponding error message is displayed.

16.11.2.2 MCP/EKS as network participant cannot be accessed

Error	Possible error causes and remedies
The MCP/EKS cannot be accessed as network participant.	
	Error cause 1
	There is no physical network connection. **Notice**: The display only refers to the circumstance that the direct connection from MCP/EKS to the next connection nodes has not been established, i.e. • The Ethernet cable is not directly inserted at the MCP/EKS, • The Ethernet cable is not inserted at the direct connection partner or the partner is not available (e.g. MCP), • The Ethernet cable connected to the MCP/EKS is defective.
	Remedy
	Establish the physical network connection (check the plug-in connections, replace the cable, check the connection partner).
	Error cause 2
	The physical network connection does not exist after the next connection node to the system network. There is no physical connection from the MCP/ECS to the computer with the active DHCP server. The cables are either defective, have not been inserted or switches have not been closed. Switches can also be located on the MCP or distribution box.
	Remedy
	Establish the physical network connection (check the plug-in connections, replace the cable, check the connection partner). Once the connection has been established, the TCU continues to boot.
The MCP/EKS cannot be accessed as network participant. There is a physical network connection to the system network.	
	Cause of the error
	No active DHCP server is found in the system network. Possible causes: • Only a single computer has been configured in the system network with active DHCP server - and this computer is not available. The system network is not operated with synchronizing DHCP servers. • No computer has been configured in the system network with active DHCP server. DHCP operation is disabled on all potential computers (NCU, PCU). This is a configuration error. • In the system network, there is no NCU or PCU computer available that has DHCP operation activated on it and could be a server.
	Remedy
	In the system network, configure a computer that is available as DHCP server.

16.11.2.3 HMI on the PCU cannot establish a network connection to the NC

Error	Error cause 1	Remedy
HMI displays alarm 120202 "Wait for connection to NC/PLC" and/or no values (only '#').	The IP address of the target NCK/PLC set on the PCU is incorrect.	From the HMI, correct the target address for NCK/PLC and restart the PCU.

Error	Error cause 2.1	Remedy
HMI displays alarm 120202 "Wait for connection to NC/PLC" and/or no values (only '#').	The PCU has an IP address that does not belong to the network or has an invalid IP address. The TCU support is deactivated on the PCU (= DHCP is disabled) and the PCU either operates with a permanently set IP address that does not belong to the network, or with the standard Windows DHCP client to dynamically retrieve addresses. This is a configuration error.	Correctly set the network settings for the system network in the Windows service mode (set the fixed specified IP address and subnet mask for the system network, use the addressing mode, fixed IP address). Execute the following actions using the "System Network Center" program: • Connect the DHCP service to the interface for the system network • Set the DHCP mode (TCU support, DHCP SyncMode, address range of the addresses that can be assigned) • Initiate DHCP clear

Error	Error cause 2.2	Remedy
HMI displays alarm 120202 "Wait for connection to NC/PLC" and/or no values (only '#').	The PCU has an IP address that does not belong to the network or has an invalid IP address. The TCU support is activated on the PCU (= DHCP is enabled) and the PCU is active DHCP-/DNS server (either as a result of the DHCP SyncMode ON_MASTER or as a result of the Sync priority - just the same as the other server candidates and random selection) - or the PCU is a DHCP client. As a result of a software error or the actual network configuration, the PCU cannot obtain a valid IP address (e.g. '0 address').	Correctly set the network settings for the system network in the Windows service mode (set the fixed specified IP address and subnet mask for the system network, use the addressing mode, fixed IP address). Execute the following actions using the "System Network Center" program: • Connect the DHCP service to the interface for the system network • Set the DHCP mode (TCU support, DHCP SyncMode, address range of the addresses that can be assigned) • Initiate DHCP clear In addition, at the station with DHCP master (DHCP SyncMode = ON_MASTER) a DHCP clear should be initiated.

Error	Error cause 2.3	Remedy
HMI displays alarm 120202 "Wait for connection to NC/PLC" and/or no values (only '#').	The PCU has an IP address that does not belong to the network or has an invalid IP address. The TCU support is activated on the PCU (= DHCP is enabled) and the PCU is active DHCP-/DNS server (either as a result of the DHCP SyncMode ON_MASTER or as a result of the Sync priority - just the same as the other server candidates and random selection). The PCU is set with an incorrect IP address and an incorrect IP range for the IP addresses that can be dynamically allocated. The PCU possibly changed from DHCP standby to active server as the computer with DHCP MASTER has failed or been switched-off.	Correctly set the network settings for the system network in the Windows service mode (set the fixed specified IP address and subnet mask for the system network, use the addressing mode, fixed IP address). Execute the following actions using the "System Network Center" program: • Connect the DHCP service to the interface for the system network • Set the DHCP mode (TCU support, DHCP SyncMode, address range of the addresses that can be assigned) • Initiate DHCP clear In addition, at the station with DHCP master (DHCP SyncMode = ON_MASTER) a DHCP clear should be initiated.

Error	Error cause 2.4	Remedy
HMI displays alarm 120202 "Wait for connection to NC/PLC" and/or no values (only '#').	The PCU has an IP address that does not belong to the network or has an invalid IP address. TCU boot support is activated on the PCU (= DHCP is enabled) and the PCU is the standby DHCP/DNS server (i.e. in the role of the DHCP client). An additional active DHCP server was switched into the system network while operational; this active DNCP server also has an incorrect address range. This is a configuration error.	Correctly set the network settings for the system network in the Windows service mode (set the fixed specified IP address and subnet mask for the system network, use the addressing mode, fixed IP address). Execute the following actions using the "System Network Center" program: • Connect the DHCP service to the interface for the system network • Set the DHCP mode (TCU support, DHCP SyncMode, address range of the addresses that can be assigned) • Initiate DHCP clear In addition, at the station with DHCP master (DHCP SyncMode = ON_MASTER) a DHCP clear should be initiated. Switch the complete system off and on again.

Error	Possible error causes and remedies
HMI displays alarm 120202 "Wait for connection to NC/PLC" and/or no values (only '#').	
	Error cause 3.1
	The NCU has an IP address that does not match the network or has an invalid IP address. The NCU does not participate in DHCP operation and runs with a permanently set IP address that is incorrect and does not match the system network.
	Remedy 3.1
	Connect the service PG to the NCU via X127. Log into Linux via WinSCP or Putty. Using the service command 'sc show ip -eth0', display the actual settings - and check these. If the cause of the error is confirmed, then the NCU must be reparameterized. Perform the service commands and settings: • sc enable DHCPSvr –X120 or the equivalent sc enable DHCPSvr –eth0 to activate DHCP operation • sc enable DHCPSync –X120 -LOW|HIGH|MASTER or equivalent sc enable DHCPSync –eth0 -LOW|HIGH|MASTER to set the DHCP synchronization mode of this NCU Enter the following entries correctly in the /user/system/etc/basesys.ini file :[InternalInterface] ; With InternalIP and InternalNetMask (both must be set together), ; you can change the address on the internal/TCU/automation/system net. InternalIP=192.168.214.1 InternalNetMask=255.255.255.0 … ; This is the range of dynamic IPs given out by the DHCP server ; Defaults should be sensible InternalDynRangeStart=192.168.214.10 InternalDynRangeEnd=192.168.214.239 The values in green should be set corresponding to the overall system. Then restart the NCU.
	Error cause 3.2
	The NCU has an IP address that does not match the network or has an invalid IP address. The NCU participates in DHCP operation and the NCU is an active DHCP/DNS server (either as a result of the DHCP SyncMode ON_MASTER or as a result of the Sync priority - just the same as the other server candidates and random selection). The NCU is set with an incorrect IP address and an incorrect IP range for the IP addresses that can be dynamically allocated. The NCU possibly changed from DHCP standby to active server as the computer with DHCP MASTER has failed/has been switched-off.
	Remedy 3.2 The same as for remedy 3.1
	Error cause 3.3
	The NCU has an IP address that does not match the network or has an invalid IP address. The NCU participates in DHCP operation and operates with the incorrect IP address. After the NCU booted, an additional component that is already operational (NCU or PCU) with active DHCP server was connected to the network. An additional active DHCP server was switched into the system network while operational; this active DNCP server has an incorrect address range. This is a configuration error.
	Remedy 3.3 The same as for remedy 3.1

Error	Possible error causes and remedies
HMI displays alarm 120202 "Wait for connection to NC/PLC" and/or no values (only '#').	
	Error cause 4.1
	The NCU has a valid IP address in the system network, however, not the required IP address. The NCU does not participate in DHCP operation and operates with a permanently set target address that is different from that saved in MMC.INI in the system network - however, this is a valid address. This is a configuration error.
	Remedy 4.1
	Connect the service PG to the NCU via X127. Log into Linux via WinSCP or Putty. If the set NCU mode (no DHCP) is to be kept, the fixed IP address of the NCU must be changed. Correctly enter the following entries into the file /user/system/etc/basesys.ini [InternalInterface] ; With InternalIP and InternalNetMask (both must be set together), ; you can change the address on the internal/TCU/automation/system net. InternalIP=192.168.214.1 InternalNetMask=255.255.255.0 Then restart the NCU.
	Error cause 4.2
	The NCU has a valid IP address in the system network, however, not the required IP address. The NCU does not participate in DHCP operation and operates with a permanently set target address that is different from that saved in MMC.INI in the system network - however, this is a valid address. This is a configuration error.
	Remedy 4.2 The same as for remedy 4.1
	Error cause 4.3
	The NCU has a valid IP address in the system network, however, not the required IP address. The NCU participates in DHCP operation and was not able to obtain the corresponding required IP with the target address saved in the MMC.INI; this is the reason that it was dynamically allocated an address. A reason for this could be that the required IP was configured twice in the system network, or the required IP is not in the reserved range, but is located in the dynamic address range. This is a configuration error.
	Remedy 4.3 The same as for remedy 4.1

	Error cause 4.4
	The NCU has a valid IP address in the system network, however, not the required IP address. The NCU participates in DHCP operation as DHCP client and has a required IP that has been set but which does not match the system network. For instance, this situation occurs if a network address was used in the system network other than the default network address, but it was forgotten to change over the required IP of the NCU to this address range. The NCU is allocated an IP address that matches the system network from the dynamically allocated range, but which is different from its 'old' required IP that was not changed over. Up to and including SW 2.4.1, in this situation, the NCU cannot be addressed in the system network. The reason for this is that it has internally established its firewall regarding the required IP that was entered for it, which does not match the system network - which is why it does not respond at X120.
	Remedy 4.4 The same as for remedy 4.1
HMI displays alarm 120202 "Wait for connection to NC/PLC" and/or no values (only '#').	
	Error cause 5.1
	There is no physical connection. Possible error causes include: • A switch is not closed/has failed; this can also be the switch of an MCP • The cable connection has become loose (poor contact) • An incorrect cable was used (crossover/not crossover) • A cable being used as data link is defective
	Remedy 5.1
	Establish a physical connection.

16.11.2.4 TCU cannot establish a network connection to the HMI

Error	Possible error causes and remedies
When booting, TCU signals 'ERROR: Network connection not established'.	
	Cause of the error
	There is no physical connection. Notice: The display only refers to the situation where the direct connection of the TCU to the next connection nodes has not been established, i.e. • The Ethernet cable is not directly inserted at the TCU, • The Ethernet cable is not inserted at the direct connection partner or the partner is not available (e.g. MCP), • The Ethernet cable at the TCU is defective.
	Remedy
	Establish the physical network connection (check the plug-in connections, replace the cable, check the connection partner). Once the connection has been established, the TCU continues to boot.

Error	Possible error causes and remedies
When the TCU boots, it signals 'connection established – no DHCPServer available'.	
	Cause of the error
	The physical network connection does not exist after the next connection node to the system network. There is no physical connection from the TCU to the computer with the active DHCP server. The cables are either defective, have not been inserted or switches have not been closed. Switches can also be located on the MCP or distribution box.
	Remedy
	Establish the physical network connection (check the plug-in connections, replace the cable, check the connection partner). Once the connection has been established, the TCU continues to boot.
When the TCU boots, it signals 'connection established – no DHCPServer available'. There is a physical network connection to the system network.	
	Cause of the error
	No active DHCP server is found in the system network. Possible error causes include: • Only a single computer has been configured in the system network with active DHCP server - and this computer is not available. The system network is not operated with synchronizing DHCP servers. • No computer has been configured in the system network with active DHCP server. DHCP operation is disabled on all potential computers (NCU, PCU). This is a configuration error. • In the system network, there is no NCU or PCU computer available that has DHCP operation activated on it and could be a server.
	Remedy
	In the system network, configure a computer that is available as DHCP server.
After it has booted, the TCU displays 'Waiting for HMI'. (The TCU cannot establish its connection to the HMI.)	
	Error cause 1
	The connection to the HMI has not been established - neither the connection configured in config.ini nor the default connection. An incorrect address for the HMI connection after booting has been set in the config.ini file.
	Remedy
	Correct the configuration using the "System Network Center" program. The TCU automatically reboots.
	Error cause 2
	The connection to the HMI has not been established - neither the connection configured in config.ini nor the default connection. The computer, to which the TCU should connect after booting according to the configuration in config.ini, cannot be reached because the computer is not switched on/is not available.
	Remedy
	Switch off the computer (NCU or PCU) and switch on again.
	Error cause 3
	The connection to the HMI has not been established - neither the connection configured in config.ini nor the default connection. The HMI on the computer, to which the TCU should connect after booting according to the configuration in config.ini, cannot be reached because the HMI is deactivated.
	Remedy
	Activate the HMI on the NCU using the service command sc enable HMI.

Error	Possible error causes and remedies
	Error cause 4
	The connection to the HMI has not been established - neither the connection configured in config.ini nor the default connection. The HMI on the computer, to which the TCU should connect after booting according to the configuration in config.ini, cannot be reached because the HMI has either not start or has crashed due to a software error.
	Remedy
	Switch off the computer (NCU or PCU) and switch on again.

16.11.2.5 The TCU cannot establish a network connection to the assigned PCU

Error	Possible error causes and remedies
The PCU does not have the IP address specified in the configuration, but an address from the IP range of the system network that can be dynamically allocated. In this error case, the TCU cannot reach its configured PCU for display.	
	Error cause 1
	IP address assigned twice The PCU has a default IP address which is also configured for another NCU/PCU. This means that an IP address has been assigned twice and therefore there is a system configuration error. The PCU is not an active DHCP server (otherwise, it would have the required IP), however, it is operated in the synchronizing DHCP mode. As the address requested from the PCU has already been assigned, the PCU is allocated an address from the dynamic address range via DHCP.
	Remedy
	A decision has to be made which computer should keep the IP address that has been assigned twice. If it is the PCU, then • on the PCU, under network settings, this address should be again set as fixed IP address in the system network, • at the NCU/PCU which runs in the DHCP synchronization mode ON_MASTER, a 'Clear DHCP' should be executed (for an NCU sc command sc clear dhcp –X120, for a PCU using the "System Network Center" program). • at the computer, which uses the IP address assigned twice as second computer, the IP address should be re-configured. Notice: If this is a PCU, then it should be linked to this new address using the "System Network Center" program (this is the first screen in the program). If the PCU is to change its address, then on the PCU • under network settings, the new address should be set as fixed IP address in the system network, • linked to this new address using the "System Network Center" program (first screen in the program) • at the NCU/PCU, which runs in the DHCP synchronization mode ON_MASTER, a 'Clear DHCP' should be executed (for an NCU using the sc command, for a PCU, using the "System Network Center" program). Restart the system.

	Error cause 2
	This was preceded by replacing the PCU hardware. As a result of the hardware replacement, in spite of the same settings of the new PCU, the requested (set) IP address is still internally reserved for the previous hardware as this is an inherent feature of the system. The PCU is either active or non-active DHCP server, however, is operated in the synchronizing DHCP mode. As the address requested from the PCU is still reserved, the PCU is allocated an address from the dynamic address range via DHCP.
	Remedy
	Perform the following steps: • Under network settings, on the PCU, set the required address again as fixed IP address in the system network. • At the NCU/PCU, which runs in the DHCP synchronization mode ON_MASTER or is active DHCP server, execute a 'Clear DHCP' (for an NCU using the sc command sc clear dhcp – X120, for a PCU, using the "System Network Center" program). • Restart the system.
	Error cause 3
	An address that does not belong to the network has been configured for the PCU. An address has been configured for the PCU, which does not match the network address in the system network, and is therefore dynamically assigned an IP address from the active server via DHCP. The PCU is not an active DHCP server, but is operated in the synchronizing DHCP mode.
	Remedy
	Perform the following steps: • Under network settings, on the PCU, set the required address again as fixed IP address in the system network. • On the PCU, using the "System Network Center" program, link the DHCP service to this new address (first screen in the "System Network Center" program), if required, adapt the other DHCP settings (dynamic address range). • At the NCU/PCU, which runs in the DHCP synchronization mode ON_MASTER or is active DHCP server, execute a 'Clear DHCP' (for an NCU using the sc command sc clear dhcp – X120, for a PCU, using the "System Network Center" program). • Restart the system.

16.11.3 Configuring TCP/IP diagnostics

The configuration of the network adapter is displayed in the "TCP/IP Configuration" window.

System network

On the system network, process data communication and image transmission of the components are executed with the operating software for the display units (TCUs).

A TCU and NCU are connected to the system network via Ethernet interface X120.

A PCU is connected via the ETH2 Ethernet adapter.

Company network

The company network is used, for example, to access the network drives.

An NCU is connected to the company network via Ethernet interface X130.

A PCU is connected via the ETH1 Ethernet adapter.

Availability of the network connections

Network adapter connection

White Network cable inserted

Red Network cable not inserted

Availability

The availability describes the percentage of faulty packages compared to all the sent and received packages.

Problems in the company network (e.g. logical drives that cannot be accessed, double IP address, etc.) as well as settling time during power up can result in fluctuations in availability.

Green Greater than 95%

Yellow 50 - 95%

Red Less than 50%

Details of the network connections

- **Computer name**
- **DNS name**

  Computer name of the controller as stored at the DNS server (**D**omain **N**ame **S**ervice).

- **MAC address**

  Physical address of the network adapter
- **Address type**

  Information about the configuration of the network adapter in the configuration file "basesys.ini":
  - DHCP: DHCP is active for this network adapter.

    The information behind the hyphen "-" specifies the DHCP mode of operation:

    off - DHCP is deactivated for this adapter

    Client - a DHCP client that receives an IP address and further data from a server, is running on the interface

    Server - the NCU provides a DHCP server on this interface that supplies clients on this network with IPs

    Synced Server - a protocol is active with which several NCUs synchronize with each other. This ensures that always only one of these NCUs functions as DHCP server and, for example, no double IP addresses

    are assigned.

    If a network adapter operates as "Synced Server", the "State of sync. DHCP server" line displays additional information.

    If no changes have been made for the network adapters in the configuration file, then "Default" is also output.
  - Manual

    The settings IP address, subnet mask, DNS server 1, DNS server 2 and gateway are configured in the "basesys.ini".

    Note:

    In the "Change" mode, either "Manual" or "DHCP" can be selected (only for company network, X130).
- **IP address assigned**

  Current IP address of the network adapter.
- **Subnet mask assigned**
- **DHCP server**

  IP address of the network adapter (for address type "DHCP").
- **State, DHCP server**

  State of the synch. DHCP server:
  - Active (actual NCU is active in the group of all NCUs in the "Synced Server" mode and transfers the IP addresses);
  - Standby (NCU is not active, if the active server fails, this NCU could take over the task of the server).

- **Mode, DHCP synchron.**

  Priority of the synch. DHCP server:

  Low, High, Master
- **DNS server 1, DNS server 2**

  Domain Name Server
- **Gateway**
- Note

  All information that is not available is marked in the relevant table line with a hyphen "-".

Modifiable parameters

The following parameters of the company network adapter (X130) can be set by selecting the "Address type":

- Address type
- IP address
- Subnet mask
- DNS server 1 and 2
- Gateway (applies for system and company network)

Address types

- DHCP

  The values for the settable parameters IP address, subnet mask, DNS server 1, DNS server 2 and gateway are defined automatically by the DHCP server, in accordance with the entry in the "basesys.ini".
- Manual

  The values for the settable parameters IP address, subnet mask, DNS server 1, DNS server 2 and gateway can be specified manually; these are then stored in the "basesys.ini".

References

For additional information about network configuration, please refer to the following documentation:

SINUMERIK 840D sl, Operator Components and Networking (IM5)

Procedure

1. Select the "Diagnostics" operating area.

2. Press the menu forward key and the "Bus TCP/IP" softkey.

3. Press the "TCP/IP diagnostics" and TCP/IP Config." softkeys.
   The "TCP/IP Configuration" window opens.

4. Press the "Modify" softkey to change specific parameters.
   The fields that can be edited have a white background.

5. Enter the desired changes and press the "OK" softkey to confirm the entries.

6. Press the "New display" softkey to refresh the display.

16.11.4 Ethernet network diagnostics

16.11.4.1 Diagnostics of the network and DHCP server

In order to more effectively influence the commissioning, press the "Network diagnostics" softkey to easily represent the data and availability of each network node in the Ethernet. The results display of this scan process delivers, among other things, the following information:

- Component identification of the hardware
- TCP/IP address / MAC address
- DHCP server detection
- Status of the nodes

This gives you the option to test whether the current topology matches the reference topology.

Precondition

PCU 50.5 with SINUMERIK Operate as of V4.5.

Procedure

1. Select the "Diagnostics" operating area.

2. Press the menu forward key and the "Bus TCP/IP" softkey.

3. Press the "TCP/IP diagnostics" softkey.

   The "TCP/IP Diagnostics" window opens and displays the current availability of the network connections.

4. Press the "Network diagnostics" softkey to browse your networks.

   The "Network Status" window opens and displays the addresses for the HMI (X120) system network, the PN (X150) system network and the company network (X130).

   The corresponding fields in the window remain empty for non-accessible networks.

5. Press the "New display" softkey to refresh the display.

   - OR -

   Press the "DHCP server" softkey to fetch information and query the status of the DHCP server.

   The "DHCP Server" window opens.

   For each active DHCP server, the status, the role (priority), the MAC address, the TCU version and the lease version are displayed in tabular form in the upper part of the window. The required IP with the associated address area appears in the lower part of the window. Any differing data is displayed in red.

16.11.4.2 Accessible nodes

By actuating the "Accessible nodes" softkey in the network, the list of accessible stations on X120 and, if necessary, on X150, is created and displayed. The list content can be compared as current topology with a reference topology.

Note

Although handheld terminals and EKS identification systems are not determined for the list of accessible nodes, they can be added as additional nodes to the topology.

Procedure

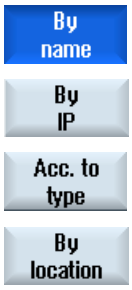
1. The "Network Status" window opens.
2. Press the "Accessible nodes" softkey.

The "Accessible Nodes" window opens.

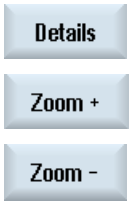
The IP address, HW-Id/type and location are displayed in tabular form for each node.

3. Press the "Sort" softkey.

4. Press the "By name", "By IP", "By type" or "By location" softkeys to sort the display.



- OR -

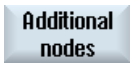


Press the "Details" softkey to call the Web interface stored for a selected node.

Note: The installed operating software must be located in the same network as the device to be displayed. If necessary, this is achieved by the assignment of a 2nd IP address (alias).

The "Details" window opens. Press the "Zoom +" or "Zoom -" softkey until the desired display size is reached.

Additional nodes



3. Press the "Additional nodes" softkey to search for nodes that are not listed under "Accessible nodes".

The "Search for Additional Nodes" window opens. If necessary, change the address range and confirm with "OK".

The found nodes are appended in the table; the HW-Id/type, Location, Contact and Description fields then can be edited and, by activating the checkbox, added to the first column, and, with a subsequent save, added to the reference topology.

Comparing

3. Press the "Compare" softkey to compare the current list of nodes either with the previously saved manufacturer topology, a reference topology or a saved topology in the .xml format.

The "Compare with" window opens. Position the cursor on the desired option box and confirm with "OK".

Deviations during the comparison are identified by being color-highlighted:

- Red: missing or non-accessible components compared with the reference topology.
- Pink: components that deviate in their attribute values compared with the reference topology.
- Blue: new components not contained in the reference topology.

Saving

3. Press the "Save" softkey to save the current topology.

The "Save as" window opens.

4. Position the cursor on the desired option box, specify a file name and possibly a comment, and confirm with "OK".

NOTICE
Manufacturer topology and reference topology can only be created with access level 1 (manufacturer) or 3 (user) and are always saved on the active DHCP server.

Default storage locations:

- Current topology (.xml or .csv):

  The following storage locations are offered depending on the configuration:

  – Network topology (storage location: HMI-data / data backups)
  – Local drive
  – Network drives
  – USB

  In CSV format, ";" is preset as a separator; it can be changed in sldgconfig.xml
- Reference topology:

  /user(_base)/common/tcu/$soll
- Manufacturer topology:

  /oem(_base)/common/tcu/$soll

16.12 Drive system

16.12.1 Displaying drive states

Status display

The "Drive System Diagnostics" window displays the status information about the drive units and the associated drive objects. The status symbols have the following meaning:

Display icon		Meaning
	Green	The drive object is in (cyclic) operation, without any detected problems.
	Yellow	The drive object has detected a less serious problem, i.e. a warning is pending, for example, or enables are missing.
	Red	This drive object has detected a serious problem, for example, an alarm is pending.
	Gray	The drive status could not be determined for this drive object.
#	Special characters	Error when reading the data.

Procedure

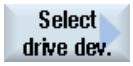
1. Select the "Diagnostics" operating area.

2. Press the menu forward key and the "Drive system" softkey.

3. The "Drive System Diagnostics" window opens.
   The name of the selected drive object is displayed in the window title.

   Press the "Drive object +" or "Drive object -" softkey.
   The next (+) or previous (-) drive object is selected.

   - OR -



   Press the "Select drive unit" softkey.
   The "Select Drive Unit" window opens.

4. Select the desired drive unit via the drop-down list box and press "OK" to confirm the selection.

See also

To obtain detailed information for every drive object, press the "Details" softkey (Page 302).

16.12.2 Displaying details of the drive objects

Drive system diagnostics - details

The following information is displayed for the drive objects:

- Status display (r0002)
  - The status display (parameter r0002) of the drive object is displayed.
- Missing enable signals (r0046)
  - The enable signals are diagnosed except for the drive objects that do not have enable signals (e.g. Control Unit). Missing enables are shown in a pane below the displays.

- Commissioning parameter filter
  - (p0009) – control unit

    The value of the "Device commissioning parameter filter" control unit parameter (p0009) is displayed.
  - (p0010) – further drive object

    The value of the "Drive object commissioning parameter filter" parameter (p0010) is displayed.
- Current fault

  The alarm number of the actual drive object fault is displayed or "No fault present", when no drive object fault is pending.

  You obtain an overview of the pending faults with the following data in an additional window:
  - Alarm number
  - Time: Date and time
  - Alarm text
- Current warning

  The number of the current drive object warning is displayed or "No warning present", when no drive object warning is pending.

  You obtain an overview of the pending alarms with the following data in an additional window:
  - Alarm number
  - Time: Date and time
  - Alarm text

Meaning of the symbols

Display icon		Meaning
	Green	The relevant value of the drive object signals no problem detected.
	Yellow	The relevant value of the drive object signals a less serious problem, i.e. a warning is pending, for example, or enables are missing.
	Red	The relevant value of the drive object signals a a serious problem, for example, an alarm is pending.
	Gray	The drive status could not be determined for this drive object.
#	Special characters	Error when reading the data.

Procedure

1. Select the "Diagnostics" operating area.

2. Press the menu forward key and the "Drive system" softkey.

The "Drive System Diagnostics" window opens.

3. Select the drive object for which you want to display further details.

4. Press the "Details" softkey.

The "Drive System Diagnostics - Details " window opens.

The name of the drive object is displayed in the window header.

Press the "Faults" softkey.

The "Drive Unit Faults" window opens that shows an overview of the faults that have been output.

Press the "Alarms" softkey.

The "Drive Unit Alarms" window opens that shows an overview of the alarms that have been output.

You can display the pending SI messages if Safety Integrated is integrated in your controller.

16.13 Remote diagnostics

16.13.1 Adapting remote diagnostics

Depending on the operating mode, the initiative for remote diagnostics comes from the service provider or from the controller.

If the initiative comes from the controller, the "Request remote diagnostics" softkey is set-up.

The display of the "Request remote diagnostics" softkey is defined in the "tcu.ini" file under the [PINGSERVICE] section.

- Variable PingServiceMode

  0 = disable

  1 = enable

In additional variables of this section, the data for the request telegram for service should be set.

- Variable PingServerIP

  IP address of the service provider to which the request telegram should be sent, e.g. PingServerIP = 128.45.234.19

- Variable PingTransmissionData

  A text that should be sent out as data content in the request telegram,

  e.g. PingTransmissionData = help at machine 35

- Variable PingTransmissionPeriod

  The length in minutes that the telegram should be sent,

  e.g. PingTransmissionPeriod = 5

- Variable PingTransmissionInterval

  Duration in seconds after which send is repeated,

  e.g. PingTransmissionInterval = 15

- Variable PingServerPor

  Port number of the Ping service with the manufacturer,

  e.g. PingServerPort=6201

16.13.2 Remote diagnostics via Teleservice adapter IE at X127

The following settings must be made for remote diagnostics via modem using a Teleservice adapters IE (TS Adapter) that is connected at X127:

Settings in the TS Adapter required

- IP address of the adapter: 192.168.215.30, subnet mask 255.255.255.224
- IP address of the caller: 192.168.215.29

  These two addresses are also stored as standard in the "tcu.ini" file. If other addresses are used, the entries "X127ModemIP" and "X127RemoteAccessIP" must be appropriately changed in the "tcu.ini" file.
- Enable the ports for the services for S7 communication, http, HTTPS, SSH as well as VNC (port 5900) in the firewall.

Connecting the modem for remote diagnostics

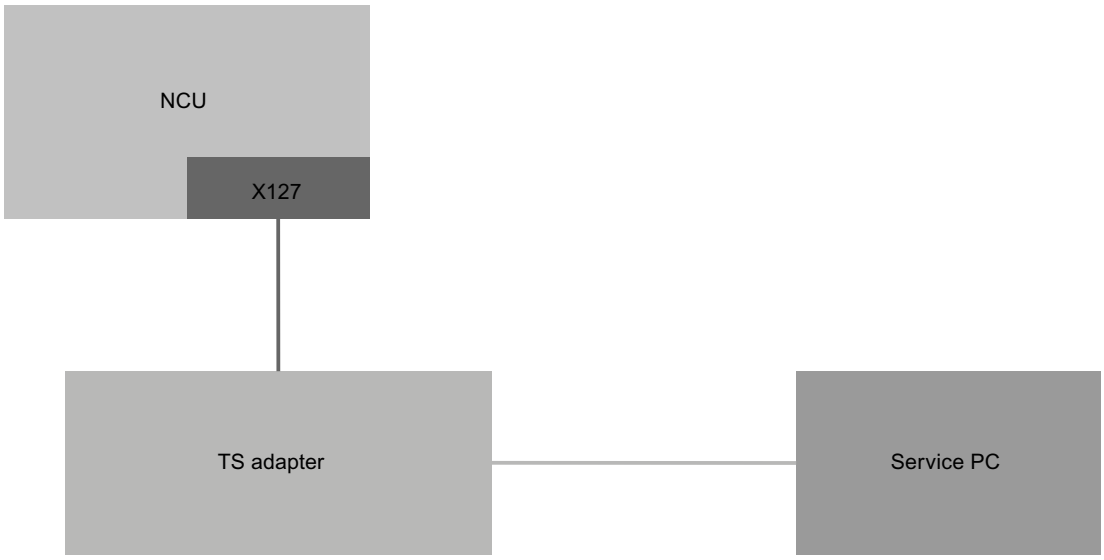


Figure 16-1 Basic system with SINUMERIK Operate on NCU (and operating station with TCU)

With the previously mentioned settings and the default values, in this configuration, remote diagnostics via TS Adapter is possible without any additional changes having to be made.

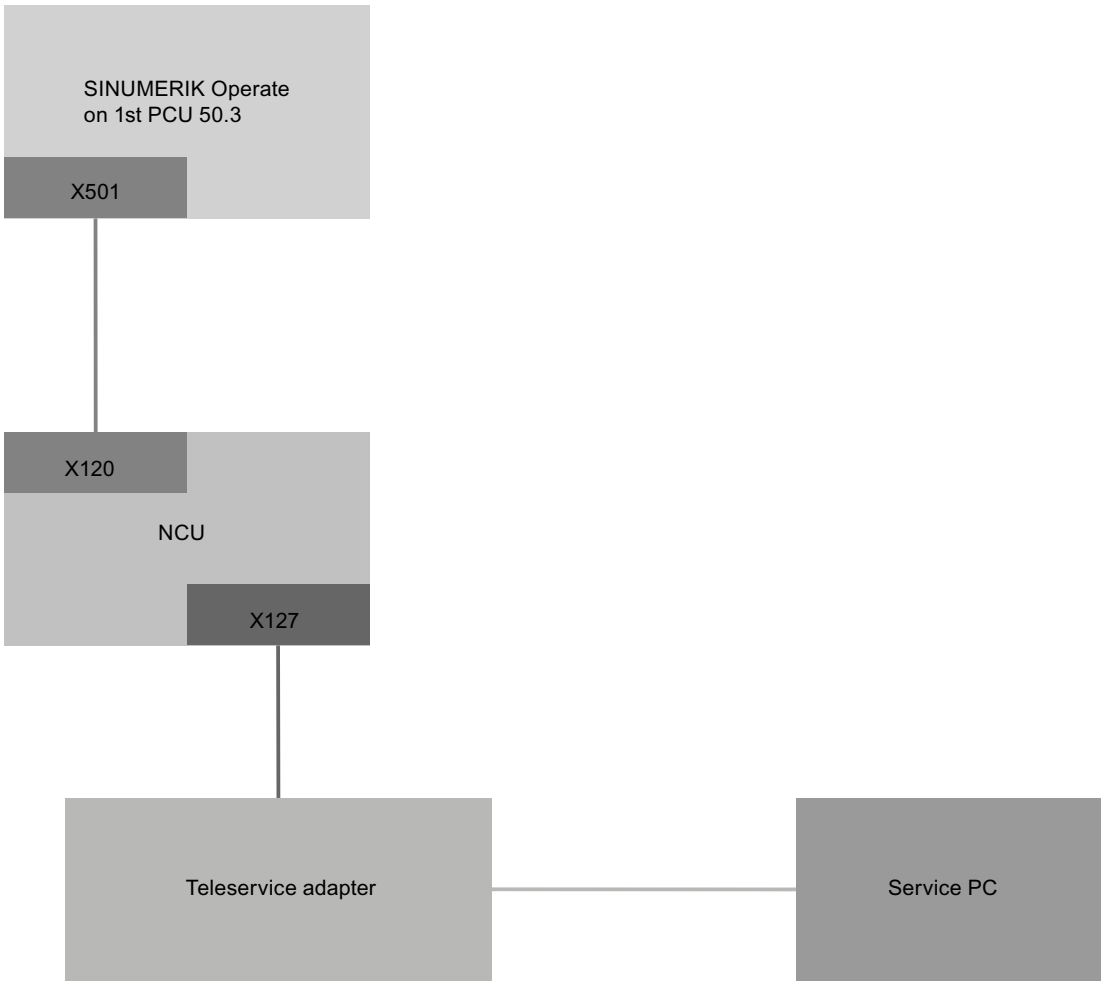


Figure 16-2 Basic system with SINUMERIK Operate on PCU

With the previously mentioned settings and the default values, in this configuration, remote diagnostics via TS Adapter is possible without any additional changes having to be made. When operating a SINUMERIK Operate on a PCU, the SINUMERIK Operate in the NCU must be switched off.

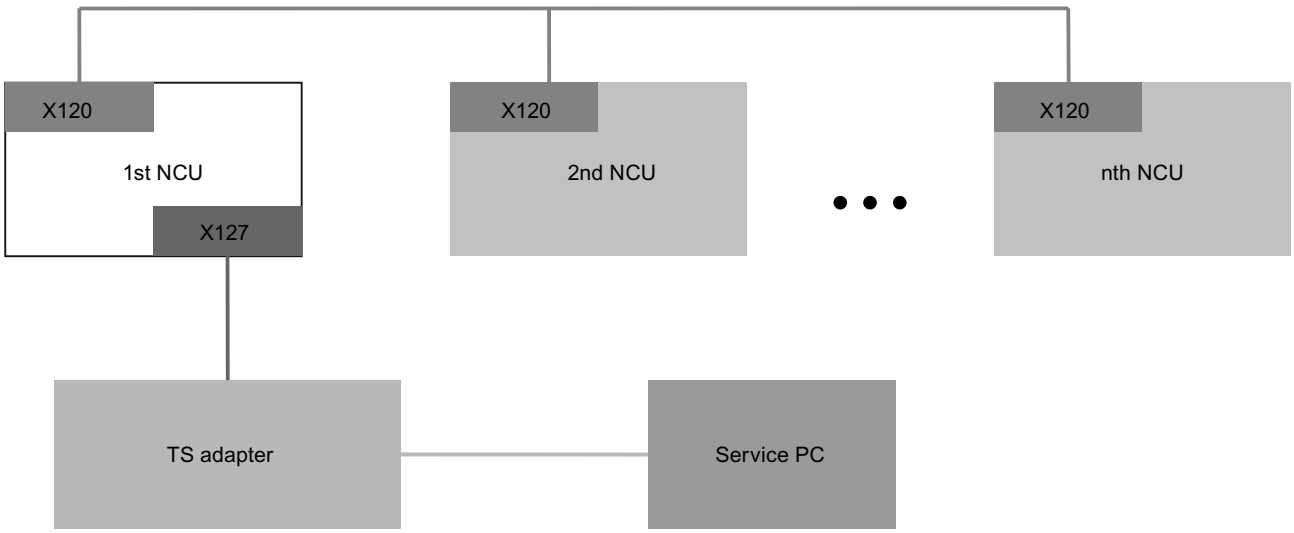


Figure 16-3 System with several NCUs and a fixed modem

The "MC Information System RCS Host" option only has to be set for the NCU to which the TS Adapter is connected at the X127 interface. Modem access can only be permitted by making the appropriate entries at the SINUMERIK Operate in this NCU and the "Request remote control" function executed. If modem access is permitted, then the service PC implicitly has access to all other NCUs and their operating software. On the other hand, the operating screens to control the remote access can be used and set at each station (SINUMERIK Operate in the NCU) individually for the station in conjunction with the relevant local PLC.

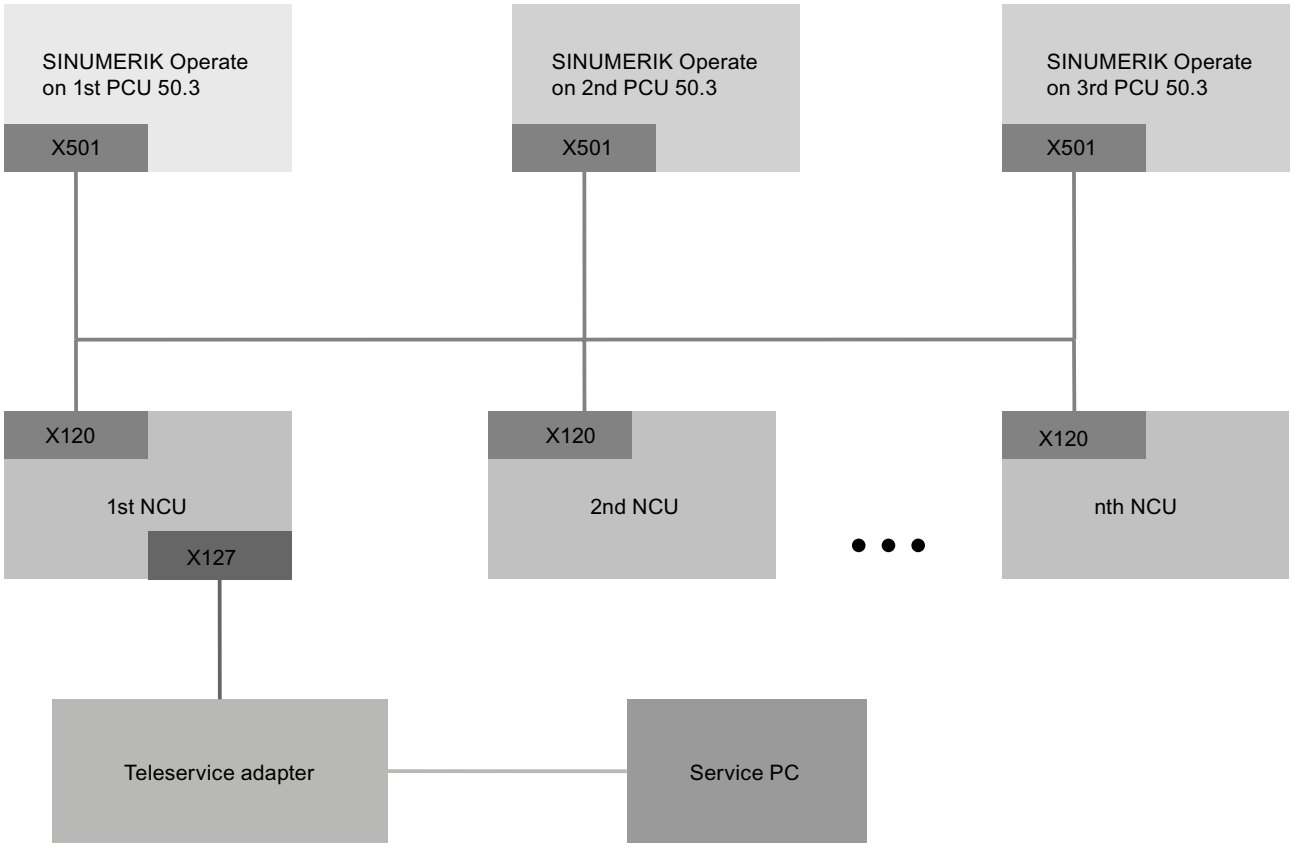


Figure 16-4 System with several NCUs, several PCUs and a fixed modem

The "MC Information System RCS Host" option only has to be set for the NCU to which the TS Adapter is connected at the X127 interface. Modem access can only be permitted by making the appropriate entries at the SINUMERIK Operate on the PCU that is assigned to this NCU and the "Request remote control" function executed. If modem access is permitted, then the service PC implicitly has access via the plant or system network to all other NCUs and PCUs and their operating software. The operating screens to control the remote access can be individually used and set at each station (SINUMERIK Operate in the NCU) for the station in conjunction with the relevant local PLC.

16.13.3 PLC control for remote access

In the PLC user program, you can control external viewers using the following settings.

DB19.DBX1.0	PLCExtViewerReject		
Value	= 0	= 1	
Meaning	Permit remote control	No remote control	
DB19.DBX1.1	PLCExtViewerMode		
Value	= 0	= 1	ignored
Meaning	Operating rights for remote control	Only monitoring for remote control	-
Result	Operating rights for remote control	Only monitoring for remote control	No remote control

16.14 Trace

The trace provides you with an oscilloscope function that allows the following data (signals) to be graphically displayed:

- General NCK data
- PLC data

Trace session

The function is used for troubleshooting and resolving faults as well as to analyze the machine and process performance. In a session, data (signals) are recorded briefly before and after an event.

Graphic display

The recorded data are optically displayed in the form of curves, the so-called characteristics graphs.

You have the option of individually setting the recording type.

Saving and downloading data

You can store the recorded data in an XML file. The saved file can then be re-loaded so that it can be evaluated at a later time.

Recording fundamentals: Signals (data)

Signals (data) specify what is to be recorded:

- NC variables (axis data, drive data, channel data etc.)
- PLC data

Cyclic events


Interpolation clock cycle (IPO clock cycle)

PLC cycle OB1


Position control clock cycle (servo clock cycle)

Non-cyclic events

Starting a session

- Recording using a trigger
- Manually starting and stopping a trace

Analyzing the result

The following functions are available to analyze the result:

- Scaling characteristic graphs
- Zooming characteristic graphs
- Defining a characteristic range using markers

16.14.1 General procedure

Sequence

- Create a trace session file as follows:
  - Select the variable and define its representation type, see Variable for Trace (Page 315)
  - Set the graphics window, and the memory mode, see Trace settings (Page 321)
  - Set the trigger property to define the start and end of recording, see Trace options (Page 321)
- Save the recording and its associated properties that have been set, see Saving the trace file (Page 312)
- Analyze the result by making the settings for the display in order to view additional details (e.g. zoom in, scroll, select section, etc.), see Evaluate a trace (Page 324)

See also

Setting-up a trace (Page 322)

16.14.2 Trace session

16.14.2.1 Creating a session file

Procedure

1. Select the "Diagnostics" operating area.

2. Press the menu forward key.

3. Press the "Trace" softkey.

4. Press the "Load trace" and "New" softkeys.
   The "New Session" window opens in which the "Session" name is recommended. The file format is automatically specified as ".xml".

5. Supplement the file name or enter a new file name and press the "OK" softkey.
   You return to the "Select Variables: ...." ...." window.
   The name of the session that has been newly created is displayed in the header.

See also

Selecting a variable (Page 315)

16.14.2.2 Saving the trace file

There are two options of saving a trace session:

- Variables and settings: Only the variables and the settings are saved.
- Variables, settings and recorded values: The variables, settings and the recorded values are saved.

Procedure

1. You have edited an active trace session.

2. Press the "Store trace" softkey.
   The "Save Trace: Session ... " window opens and offers the following storage options.

3. Activate the corresponding checkbox and press the "OK" softkey.
   The "Store Trace" window opens and specifies the file name in the "Name of trace file:" entry field. The file format is automatically specified as ".xml" and cannot be changed.

4. Press the "OK" softkey to save the session file.
   If the session file already exists, then you obtain a corresponding confirmation prompt.
5. Press the "OK" softkey if you wish to overwrite the existing session files.

   - OR -

   Press the "Save as" softkey if you do not wish to overwrite the existing session file.
   A new name is suggested but you can specify a name yourself.

   - OR -

   Press the "Change directory" softkey if you wish to store the session file in a directory other than in the standard "Trace" directory.
   The data tree opens and you can select between the configured drives.

   Then press the "New directory" softkey if you wish to create a new directory.
   The "New Directory" window opens in which you can assign a directory name.

   Press the "OK" softkey.
   The "Store Trace" window opens in which the names of the target directory and the session file are displayed.
   You can change the name of the session file.

6. To save the session file, press the "OK" softkey one more time.

   - OR -

   If the session file with this name already exists, then you obtain a corresponding confirmation prompt.

16.14.2.3 Load trace session file

You have the option of loading already saved session data, to restart them or to display the trace that has been recorded.

Settings	Meaning
Variables, settings	You can restart a trace session that has already been created.
Variables, settings and recorded values	You can view the result of a trace session, change the variable and if required, restart.

Precondition

A session file of recorded traces is available.

Procedure

1. You have selected the "Trace" function.

2. Press the "Load trace" softkey.
   The "Load Session File: Please Select File" window opens.

3. Select the desired session file from the appropriate directory, e.g. "Trace", and press the "Display trace" softkey.
   The "Load trace: session..." is opened.
4. Select the checkbox "Variables, settings", if you wish to immediately start the trace session.

5. Press the "OK" softkey and the "Start trace" softkey to restart the trace.

   - OR -

   Select the checkbox "Variables, settings and recorded values", if you wish to display the trace session.

   Press the "OK" softkey.
   The data of the selected session are loaded displayed in the "Trace" window.

16.14.3 Variable for Trace

16.14.3.1 Selecting a variable

Selection of variables

To limit the selection of variables, set a filter and/or enter an initial value for the search. The following filters are available for selection:

Filter	
Drive parameters	Displaying the drive parameters
System variables	Displays the system variables
NC	Display of NC, axis and channel signals as well as signals of the mode group in the OPI notation.
Axis	
Channel	
Mode groups	
Servo	Displays the servo-trace signals
PLC	Displays the PLC signals
PLC alarms	Displays the manufacturer-specific PLC alarm signals
All (no filter)	Displays all signals without filter: NC, axis and channel setting data as well as signals of the mode group in the OPI notation.

Note

"Filter/Search" when inserting variables

The start value for "Filter/Search" of variables differs.

For example, to insert the variable $R[0], set "Filter/Search":

- The start value is 0, if you filter according to "System variables".
- The start value is 1, if you filter according to "All (no filter)". In this case, all signals are displayed and shown in the OPI notation.

Procedure

For a trace session, in the window "Selected Variables for Trace: Session ... " set the variables whose signals are to be traced.

1. In the "Select variables for trace: Session..." window, a trace session is displayed.
2. Position the cursor in the "Variable" column in an empty line.

   - OR -

Position the cursor in the "Variable" column on a variable that you wish to replace by another.

Insert variable

3. Press the "Insert variable" softkey.
   The "Select Variable" window opens.

   Note:
   When selecting a "Drive parameter", firstly select the drive object (DO) and then insert the desired parameter from the list of corresponding parameters.

Filter/ search

4. Press the "Filter/search" softkey to start a specific search.
   In the "Filter" selection box, select a variable area.

   - OR -

   Directly enter the variable into the "Search" entry field.

   The cursor jumps to the term that is found.

Clear search

   Press the "Delete search" softkey if you wish to terminate the search.

Add

5. Press the "Add" softkey to enter the required variable into a trace session.
   The "Variable Attributes" window opens and you can select the appropriate value (e.g. channel data, drive bus no.) from a combobox.

   - OR -

Replace

   Press the "Replace" softkey to replace an already selected version by another one.

OK

6. Press the "OK" softkey to add or replace the variable.
   Each variable is automatically allocated a reference number, which is displayed in the upper section of the window. This number is opened automatically allocated. If a version is removed, then the following variables are re-numbered.
7. Now, select the desired settings for display, such as color, pen, qty. event etc.

Editing variables of a trace session

Function	Meaning
Ctrl + X or right-click, shortcut menu "Cut"	Press the key combination or open the shortcut menu in order to cut out a variable.
Ctrl + C or right-click, shortcut menu "Copy"	Press the key combination or open the shortcut menu in order to copy a variable.
Ctrl + V or right-click, shortcut menu "Paste"	Press the key combination or open the shortcut menu in order to insert a variable.

16.14.3.2 Selecting attributes of a variable

Attributes

For a trace session, select the variables and assign the corresponding attributes:

Column	Meaning
Variable	Address of the variables

Attributes	Meaning
Comment	• Name of the selected variables • A general description for the variables.
Color	Color selection, the representation of the characteristic graphs. When creating a variable, the next color from the available palette is automatically used.
Pen	Line type selection to display the characteristic graphs. • No line • Solid line • Dashed line • Dash-dot line • Dash-dot-dot line • Dotted line • Stepped line XY • Stepped line YX • "* line" (line made up of * symbols) • + line • X line
Qty.	Defines whether the characteristic of the variables is displayed in the "Trace" window. If the checkbox is not selected, then no characteristic graphs are displayed.
Events	Event selection which triggers that the signal is traced:

Attributes	Meaning
	• Interpolation clock cycle (IPO clock cycle) • Interpolation cycle (IPO2) • Position control clock cycle (servo clock cycle) • PLC cycle OB1 • Drive trace rate • Start geometry axis/direction change • Stop geometry axis • Machine axis start / direction change • Machine axis stop • NC start (program runs) • NC start (program ran) • Start of the data recording
	• Block start, type 1 or block end (all program levels, without intermediate blocks) • Block start, type 2 or block end (all program levels, with intermediate blocks) • Block start, type 3 or block end (all main programs, without intermediate blocks) • Block start or block end, block search (all program levels, without intermediate blocks) • Geo axis start / direction change (2nd event) • Geo axis stop (2nd event) • Block start, type 2 (2nd event: all program levels, without intermediate blocks) • Block end, type 2 (2nd event: all program levels, with intermediate blocks) • Block start, block advance, type 1 (2nd event) • OEM test event 1 (non-cyclic, block advance) • OEM test event 2 (non-cyclic, main run)
	• Activate/deactivate synchronized action • Synchronized action initiated (condition fulfilled) • Signaled alarm • Cancel softkey pressed • Program level change • Block end (Interpreter) • Trace end (last event!) • Start trace

Attributes	Meaning
	• WRTPR part program command • WRTPR part program command (block search) • Tool change • Cutting edge change • Tool change (block search) • Cutting edge (block search) • Start trigger initiated • Stop trigger initiated • Block end (block advance) • Block end (2nd event: Block search) • WRTPR part program command (block advance) • Tool change (block advance) • Cutting edge (block advance)
Event channel	This means that the channel can be defined in SINUMERIK in which a specific event occurs. For events which are not channel-specific, the field remains empty.
Bit mask	In the case of an integer variable, a bit mask can be specified in this field. For a bit mask, the particular signal value is AND'ed before being displayed. After the mask has been applied, all of the selected bits are moved to the right so that it looks as if the bit or the bits all start with bit zero. This means, if all bits with the exception of bit 7 have been masked, then the integer number that would have been obtained would either have a value of 0 or 1, however, not 0 or 128. If all of the bits with the exception of bit 7 and 0 have been masked, the resulting integer number would either have the value 0, 1, 2 or 3, however, not 0, 1, 128 or 129.
Decimal places	This setting is used to define how many places to the right of the decimal point are displayed at the axis identifiers.
Coord. axis	The coordinate axes are displayed to the left or right in the graphic window or there is no display.
Display Y	Value input or 0
Scale factor	Defines the scale.
Units	Displays the measurement unit, e.g. mm/min. The system specifies this and it cannot be changed.

16.14.3.3 Displaying details of a variable

You can display the most important information and settings of the display at a glance in the detail window, i.e. you do not have to use the scroll bar for example to get to the "Event" column.

Displayed information

- Variable address
- Comment with a description of the variables
- Events
- Channel, axis, access level, mode group, etc.
- Smaller graphic display with the event; when this event occurs the characteristic graphs are recorded as well as their settings, such as color, line type, etc.

Procedure

1. You are in the "Select Variables for Trace: ..." window. ...".
2. Position the cursor to the required variable.

3. Press the "Details" softkey.

   A subscreen with the most important information as well as the graphic display is shown in the lower half of the window.

   Press the "Details" softkey again to display the subscreen.

16.14.4 Trace settings

16.14.4.1 Trace options

You define the following properties of a trace session in the "Trace - Options" window.

- Setting the graphic window
  - Displaying main grid lines: You define whether a horizontal grid is displayed and in which color.
  - Displaying grid sub-lines: You define whether a vertical grid should be displayed and in which color.
  - Background: You select the background color of the graphic window.
- Defining storage options
  - Activate the "Confirm file overwrite" checkbox in order to receive a confirmation prompt each time that a trace session is to be overwritten.
  - If the checkbox is deactivated, the trace session is overwritten without a confirmation prompt.

Procedure

1. You are in the "Select Variables for Trace: ..." window. ..." and a trace session has been selected.

2. Press the "Options" softkey.
   The "Trace - Options" window is opened.

3. Select the desired settings and press the "OK" softkey in order to accept the settings.

16.14.4.2 Setting-up a trace

In the "Trace - Settings" window, you define the condition for the start and end of a trace session and the memory size.

Settings	Meaning
Starting the trace	
Using the Start Trace softkey	The session is activated by pressing the "Start trace" softkey.
Setting the trigger condition for recording.	
Variable	The session is activated using a variable. The variable is selected from a list using the "Insert variable" softkey.
Relation and value	After the session has been activated, this defines at which value the trace recording is initiated. The following values are listed in a combo box: = =, ≠, >, >=, <, <=, ascending, descending, changed.
Editing data	
Data is acquired	Defines whether the recorded data are saved on the CompactFlash card or in the NC work memory. For "NCK", the recorded data are saved on the NCU until the recording is stopped. Only then is the session file saved on the CompactFlash card. For "On hard drive", the trace unloads the data to the CompactFlash card while recording. As a consequence, more signals can be processed.
Overwrite at memory limit	Defines from which memory limit the data is overwritten (ring buffer).
Exiting the trace	
Using the Stop Trace softkey	The trace session is stopped by pressing the "Stop trace" softkey.
If the time has expired	Defines the time period which after it has expired, the trace recording is exited. You can select from the following time periods: Milliseconds, seconds, minutes, hours, days
If the memory is full	The trace session is exited if the specified data quantity (Kbytes) is reached.
Setting the trigger condition to exit the trace	
Variable	The session is deactivated using a variable. The variable is selected from a list using the "Insert variable" softkey.
Relation and value	After the session has been activated, this defines at which value the trace recording is exited. The following values are listed in a combo box: = =, ≠, >, >=, <, <=, ascending, descending, changed.
Run-on time (in sec.)	This defines how long the trace still runs after the session has been exited.
Overwrite at memory limit (Kbyte)	Defines from which memory limit the data is overwritten (ring buffer).

Procedure

1. You are in the "Select Variables for Trace: ..." window. ..." and the variable of a trace session has been selected.

2. Press the "Settings" softkey.
   The "Trace Settings" window opens.
3. Select the desired settings and enter the values.

4. Press the "OK" softkey.
   The settings are saved.

16.14.4.3 Starting the trace

In the "Trace" window, you obtain the curve with the data of the variables selected for a trace session.

The diagram comprises two Cartesian coordinates:

- Time axis

  The horizontal x axis supplies the time values.
- Value axis

  The vertical y axis displays the resolution fineness (amplitude).

Recording the trace session

- Manually starting and stopping a trace
- Starting and stopping recording using a trigger

Procedure

1. You have listed the desired variables for a trace section.

2. Press the "Display trace" softkey.
   The "Trace" window is opened. The recording is loaded and the procedure is displayed in progress window.

3. Press the "Start trace" softkey if you wish to immediately start recording.

   - OR -

   The recording is triggered by the trigger condition.

4. If you wish to manually end the recording, press the "Stop trace" softkey.

   - OR -

   The recording is stopped by the trigger condition.

16.14.5 Evaluate a trace

16.14.5.1 Setting trace views

In order to permit a precise evaluation of the recorded signals, you have the option to edit the view as well as the display of the characteristic graphs:

- Selection/legend
  - Show legend: In addition to the graphic display, the variable data are displayed as comment, numbered and in color.
  - Make a selection: You define which variables are displayed in the graphic window.
- Scale
  - Specify scaling factors for minimum and maximum X and Y value
- Zoom
  - Increasing or decreasing the section
- Cursors: The cursor display provides functions that allow one, two or both curves to be precisely measured.
  - Cursor A
  - Cursor B
  - Both cursors
  - Snap to curve: The cursor precisely moves along the curve
  - Point mode: Cursor jumps directly to various values.
  - High point mode: The cursor jumps from one peak value to the next.
  - Low point mode: Cursor jumps to the lowest values.

Precondition

The "Trace" graphic window is opened and the trace has been recorded.

Editing curves

You jump from <TAB> one variable to the next using the <TAB> key.

You jump back using the <Ctrl> and <TAB> keys.

With the cursor keys, you select marks, move to individual values and can define a zoom range.

16.14.5.2 Selecting a variable

You have the option of displaying the selected variables as legend and to make a selection using a checkbox.

Legend
Numbering the variables
Axis identifier
Comment of the variables

Displaying a legend and selecting a variable

1. A recording is opened in the "Trace" graphics window.

2. Press the "Legend / selection" softkey.
   The graphic window is halved. The variables are displayed as comment and with checkbox in the left-hand section of the window.
3. Activate or deactivate the required variable using the checkbox to display it as curve.

4. Press the softkey again to hide the legend area again.

16.14.5.3 Scaling the display

The scaling allows you to make a precise measurement of selected variables from the X time axis as well as from the Y value axis. You have the option of saving the larger or smaller display in a user-defined way

Setting	Meaning	
X minimum or X maximum	Highest or lowest value of the X time axis. The values are used for recording when the trace is started again.	
	Fixed scale, X axis	Values of the X time axis are kept.
	Strip chart recorder mode	The values of the X time axis are used while recording.
Y minimum or Y maximum	Defining the highest or lowest value of the Y value axis (amplitude).	
Offset or resolution	Defining the rms values (mean values) of the amplitudes. The scale is changed by a factor of 10.	

Scaling the time and value axis

1. A recording is opened in the "Trace" graphics window.

2. Press the "Scale" softkey in order to scale the display.

The "Select X-Y Scaling" input window opens and the values of the X time axis are displayed.

3. Press the "X time axis" softkey again if you wish to hide the values.

- OR -

Press the "Y selected curves" softkey to display the values of the Y value axis.

Press the softkey again if you wish to hide the values.

- OR -

You have selected both axes.

4. Press the "Scale +" or "Scale -" softkey until the desired scaling is reached.

- OR -

Enter the scaling values directly into the input window and select the appropriate property.

5. Press the "Scale" softkey to save the settings.

- OR -

Press the "Adapt selected" softkey to display the selected characteristic graphs in the full graphic window.

Press the "Fit one" softkey to display the selected characteristic graphs in the full graphic window.

16.14.5.4 Zooming the display

Using the zoom function, you have the option of viewing selected sections of curves in detail. After you have defined an area or a section, you can increase or decrease the size of it (zoom in or zoom out).

Procedure

1. A recording is opened in the "Trace" graphics window.

2. Press the "Zoom" softkey if you wish to zoom-in or zoom-out on the characteristic graphs.

3. The "X time axis" or "Y value axis" softkey is selected.

or

4. Press the "Adapt individually" or "Adapt all" softkey if you wish to display all selected characteristic graphs in a separate area positioned one above the other.

- OR -

Press the "Adapt together" softkey if you wish to adapt all of the characteristic graphs to the graphic window.
As all of the curves fill the complete window area, they are displayed superimposed on one another.

- OR -

Press the "Individually adapt X" softkey if you wish to normalize the X time axis only in the graphic window.

- OR -

Press the "Individually adapt Y" or "Adapt all" softkey if you only wish to scale the Y value axis in the graphic window.

or

- OR -

Press the "Adapt Y together" softkey if you wish to adapt the value axis of all characteristic graphs to the graphic window.
As all curves fill the complete window area, they are displayed superimposed.

5. Press the "Zoom +" or "Zoom -" softkey until the desired display size is reached.

Zoom in/zoom out area

Press the "Zoom area" softkey to define a specific section.
A frame is displayed.

Press the "Zoom +" or "Zoom -" softkey to change the frame step-by-step.

Press the "OK" softkey to display the zoom area.

16.14.5.5 Position the cursor

Using the cursor, you have the option of determining the precise values from a defined section. To do this, the cursor is positioned directly on the curve.

Procedure

1. A recording is opened in the "Trace" graphics window.

2. Press the "Cursor A" softkey.
   The reference number, color of the variables and the color of the coordinate crossing point are displayed on the softkey.

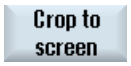
3. Position "(A)" at the position on the curve where you wish to start the measurement.
   The coordinates are specified in a tooltip and in the status line.

4. Press the "Cursor B" softkey.
   The reference number, color of the variables as well as the color of the coordinate crossing point are also displayed on this softkey.

   Position "(B)" at the position on the curve where you wish to end the measurement.

5. Press the "Both cursors" softkey to display the area between A and B.
   The coordinates of A and B as well as the difference "Δ" are displayed in the status line.

   Press the active "Cursor A" and "Cursor B" softkeys again to deselect the position.
   When re-selected, the positions are reset.



Press the "Crop to screen" softkey to display the area, defined by "Cursor A" and "Cursor B", in the complete graphic window.

Press the "Snap to waveform" softkey to move the cursor along the curve step-by-step.

16.14.5.6 Acquiring measured values

You have the option of directly determining the following values of a curve:

- Peak-to-peak value
- Peak-to-valley value

Procedure

A recording is opened in the "Trace" graphics window.

Press the "Point Mode" softkey to continuously move the cursor along the curve.

Press the "Peak Mode" softkey to position the cursor at the highest value.

Press the "Valley Mode" softkey to position the cursor at the lowest value.

If you press the "Peaks" softkey, the cursor only goes to the peak-peak values.

If you press the "Minimum" softkey, the cursor only goes to the peak-valley values.

16.15 PROFIBUS/PROFINET and AS-i bus diagnostics

16.15.1 PROFIBUS/PROFINET

With the PROFIBUS/PROFINET diagnostics, you obtain a quick overview from which, when required, you can call status and detailed information for external DP master systems and PROFINET IO systems.

Precondition for detailed diagnostics

When using HMI PRO RT, the diagnostics can be extended by additional information (e.g. module and Order No.). This data involves offline data, which can be extracted from the associated Step7 project.

- You can create offline data using the HMIPRO CS program.
- You transfer data to the control using the HMIPRO program.

Software option

For faulted modules, in order that in addition to the status information, detailed information can also be displayed, you now require the following option: "Operating software SW HMI PRO sl RT".

In order that detailed information can be displayed for PROFINET-IO systems, the PLC block FB_SL_COM from the HMI PRO block library must be used. Use DB449 as the associated instance DB.

Note

Detailed information for DP master systems is also available without using FB_SL_COM.

Diagnostics information from the DP master systems

You can configure the following versions:

1. Software option not available and HMIPRO offline data not available
2. Software option available and HMIPRO offline data not available
3. Software option available and HMIPRO offline data available

16.15.2 Displaying PROFIBUS/PROFINET diagnostics

Diagnostics information from the DP master systems

From the user interface, you can display the fieldbus diagnostics known from HMIPRO. The module state is displayed using diagnostic symbols.

The following diagnostics information is displayed depending on the particular version that you have configured:

Information for all versions		
Status		Module has a fault
		Module has failed
		Module is OK
		Module is suppressed (this is only possible with HMI PRO RT)
PROFIBUS address		PROFIBUS address data

Additional information for the 2nd version	
PROFIBUS/PROFINET module or channel diagnostics	
Device diagnostics	For Siemens DP/DP coupler and diagnostics repeater

Additional diagnostic information for the 3rd version	
Name	Module name from the HMI offline data
Name	Module name from HMI offline data
Order no.	Order no. of the module from HMI offline data
IP address	IP address of the module from HMI offline data (only for PROFINET)
Graphic display of the complete hardware configuration in a dedicated window	

Procedure

1. Select the "Diagnostics" operating area.

2. Press the menu forward key twice and the "PB/PN diag."softkey.
   The "PROFIBUS/PROFINET Diagnostics" window opens.

3. Select the required DP master system.
   The complete diagnostics information is displayed.

4. Press the "Only available" softkey to display the diagnostics data of the available modules

   - OR -

   Press the "Only suppressed" softkey to display the diagnostics data of the suppressed modules

   - OR -

   Press the "Only failed" softkey to display the diagnostics data of the failed modules.

   - OR -

   Press the "Only faulted" softkey to display the diagnostics data of the faulted modules.

16.15.3 Configuring the AS-i bus

You obtain a fast overview of the existing AS-Interface network using the AS-Interface (AS-i) diagnostics. Permanent monitoring and an error search function provide you with the following information:

- Status flags acc. to the AS-i specification
- States of the AS-i slaves

Precondition

- For AS-i diagnostics, it is absolutely necessary to use the FB_SL_COM PLC block from the HMI PRO block library.
- The configuration file "sltlprodiaghmi.ini" must be available.

AS-i components

The following AS-i components are supported:

CP142-2	(Type ID 1)
CP343-2	(Type ID 2)
DP/AS-i link	(Type ID 3)
DP/AS-i link 20E	(Type ID 4)
DP-AS-i link Advanced	(Type ID 6)

Diagnostic information

All of the AS-i components to be diagnosed must be parameterized in the "sltlprodiaghmi.ini" configuration file.

Entry		Description
`[SKO]`		
	`ComboCount=x`	Number of entries (x) in the selection list
`[SKO_Index0]`		1. Entry
	`DiagType= 6`	Type ID of the AS-i component (refer above)
	`TypeSection=DP-AS-i-Link-Advanced 1`	Designation of the AS-i component, which should be output in the selection list
	`Logical_Address=43`	E address of the AS-i component from the hardware configuration
	`RequestDB=449`	Instance DB of the function block "FB_SL_COM" being used

Example of the "sltlprodiaghmi.ini" with 5 components

```
[SK0]
ComboCount=5

[SK0_Index0]
DiagType= 1
TypeSection=CP142-2
Logical_Address=43
RequestDB=449

[SK0_Index1]
DiagType= 2
TypeSection=CP343-2
Logical_Address=75
RequestDB=449

[SK0_Index2]
DiagType= 3
TypeSection=DP-AS-i-Link
Logical_Address=75
RequestDB=449

[SK0_Index3]
DiagType= 4
TypeSection=DP-AS-i-Link-20E
Logical_Address=75
RequestDB=449

[SK0_Index4]
DiagType= 6
TypeSection=DP-AS-i-Link-Advanced
Logical_Address=75
RequestDB=449
```

Procedure

1. Copy the "sltlprodiaghmi.ini" file from the /**siemens**/sinumerik/hmi/template/cfg directory.
2. Place the file in the directory: /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg.
   If the file is already available in the directory, then just supplement this by the corresponding entries.
3. Open the file and enter the corresponding data of the AS-i components.
4. Save and close the file.
   The diagnostics information is displayed on the user interface.

16.15.4 Displaying AS-i bus diagnostics

Diagnostics information from AS-i components

Using the user interface, you have the option of displaying information about the networking of binary sensors and actuators (AS-i).

Software option

Additional error counter can be displayed for the component DP-AS-i Link Advanced if the option "Operating SW HMI PRO sl RT" is set.

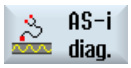
Diagnostic information

Flags acc. to the AS-i specification	Description
Offline	Offline operating state
Internal	Internal operating state
EEPROM o.k.	Internal EEPROM okay
Auto-Addr.progr. enabled	Automatic address assignment enabled
I/O fault	Peripheral fault present
Master Power On - Start	Starting after Master Power On
Offline ready	Offline phase completed
AS-i cable voltage too low	AS-i cable voltage too low
CP in normal operation	CP in normal operation
Operating mode	Operating mode state
Auto.-Addr.progr. executed	Automatic address assignment executed
Auto-Addr.progr. possible	Automatic address assignment possible
AS-i slave with addr.=0 available	Slave with address 0 available
Reference config. = actual config.	Target configuration equal to actual configuration

State	Marking
Slave OK	Green
Slave fault	Red
Slave is available, but not configured	Yellow

Procedure

1. Select the "Diagnostics" operating area.



2. Press the menu forward key twice and the "AS-i diag." softkey.
   The "Diagnostics AS-Interface" window is opened.

3. Select the required DP AS-interface.
   The complete diagnostics information is displayed.
   The values in italics indicate an error counter > 0.

16.16 Spindle diagnostics

16.16.1 Evaluation of the status signals

Software option
For the "Spindle diagnostics" you require the "S-Monitor" option.

Main spindle drives are monitored with various status signals. The DRIVE-CLiQ connection at the spindle can be used to evaluate these signals in the drive. For a more effective diagnosis of the spindle operating states, the status signals are evaluated and the following information displayed on the user interface:

- Operating hours
- Temperatures
- Speed/power
- Logistics data

Preconditions

- A spindle has an SMI24:
  r0459, bit 14 = 1.
- Drive telegram 139 is configured for the spindle.
- The spindle functionality for the machine axis is present, when:
  MD35000 $MA_SPIND_ASSIGN_TO_MACHAX > 0
  The value corresponds to the spindle number.

References

For further information, refer to the following documentation:
Basic Functions (S1), Function Manual; Section "Spindle with SMI24"

Procedure

1. Select the "Diagnostics" operating area.

2. Press the menu forward key twice.

3. Press the "Spindle diag." softkey to obtain a data overview.
   The "S1 Spindle Diagnostics" window opens.

Note

If several spindles are in operation, select the desired spindle using the "Spindle +" or "Spindle -" softkey.

Data overview

The "S1 Spindle Diagnostics" window shows the following information:

Parameter	Value
Operating hours • Spindle under control • Spindle under speed	h
Number of clamping cycles (tool change)	
Motor temperature	°C
Clamping system (sensor 1)	V
Piston free (sensor 4)	

Parameter	Value
Shaft in the change position (sensor 5)	
Load classification *)	%
Nominal residual use *)	h
Maximum speed	rpm

*) If at least one collision was detected, "Load classification" and "Nominal residual use" will be grayed-out because they no longer display any reliable values.

16.16.2 Fetch temperatures

To ensure a full temperature protection, a diagnosis of the temperatures can also be performed at low speeds or standstill. Which temperatures are displayed depends on the number and the mounting location (e.g. S6) of the used sensors, for example:

- Motor temperature (KTY84)
- Winding, full motor protection (PTC)
- S6, e.g. bearing temperature (KTY)

Procedure

1. The "S1 Spindle Diagnostics" window is open.
2. Press the "Temperatures" softkey.
   

   The "S1 Temperatures" window opens and displays the acquired data.
3. Press the "Histogram" softkey to track the temperature change of a sensor over a certain period.
   

   - OR -
   Press the "Back" softkey to return to the data overview.
   

16.16.3 Fetch speed, torque and power

To check the loads on the spindle, the speed, torque, and power are acquired in a histogram as function of the operating hours. The color coding indicates the following states:

- Light green: low load
- Green: rated load
- Yellow: high load
- Orange: critical load

Procedure

1. The "S1 Spindle Diagnostics" window is open.

2. Press the "Speed/power" softkey.
   The "S1 Speed/Power" window opens and displays in a histogram the acquired data.

3. Press the "Back" softkey to return to the data overview.

Possible conclusions

- The speed histogram is an indication of the load on the bearings and rotary gland caused by the speed.
- The speed histogram is an indication of the load on the bearings caused by the stock removal forces. The relationship between torque and radial force changes, however, depending on the tool diameter (lever arm), the milling arc (superimposition of the cutting forces of the individual cutting edges) and the cutting force coefficients (the stock removal consists of cutting force force, infeed force and passive force - only the cutting force is acquired via the torque).
- The power histogram provides an indication of the potential for a process optimization. The power histogram also allows an estimate whether the loads caused by speed and torque are superimposed over time and thus accumulated.

16.16.4 Checking the clamping system

The diagnosis of the clamping system offers the following capabilities:

- Fast and robust detection of the clamped states
- Monitoring of the clamping task and the clamping system

The sensors in the motor provide information about the clamping device and the orientation of the tool in the spindle:

Sensor	Meaning	
S1	Clamped state	Released
		Clamped with tool
		Clamped without tool
S4	Piston free	
S5	Shaft in the change position	

Procedure

1. The "S1 Spindle Diagnostics" window is open.

2. Press the "Clamping system" softkey.

   The "S1 Clamping System" window opens and displays the acquired data. The clamping state is displayed as a histogram.

Speed limitation

3. Press the "Speed limitation" softkey to change the limit values for the speeds of the clamped states.

   The "S1 Speed Limitations" window opens.

4. Press the "Change" softkey to enter the the desired speed limitations depending on the clamped state and confirm with "OK".

- OR -

3. Press the "Cycle counter diagnostics" softkey to fetch the clamping times and perform a diagnosis of the clamping system.

   The "S1 Cycle Counter and Diagnostics" window opens and displays the acquired data.

- OR -

3. Press the "Back" softkey to return to the data overview.

16.16.5 Fetching the logistics data

The following manufacturer characteristics of the spindle can be fetched via DRIVE-CLiQ:

- Manufacturer identification
- Drawing number
- Serial number
- Date of manufacture
- Service date and service information (1 ... 4):

  Can be fetched only with "Service" access level.

Procedure

1. The "S1 Spindle Diagnostics" window is open.
2. 

Press the "Logistics data" softkey.
The "S1 Logistics Data" window opens and displays the acquired data.
3. 

Press the "Back" softkey to return to the data overview.

OEM-specific online help

17

17.1 Overview

In addition to the existing extensive online help, you also have the option of generating a manufacturer-specific online help and then linking this into SINUMERIK Operate.

This online help is generated in the HTML format, i.e. it comprises HTML documents that are linked with one another. The subject being searched for is called in a separate window from a contents or index directory. Similar to a document browser (e.g. Windows Explorer), a list of possible selections is displayed in the left-hand half of the window and when you click on the required subject, the explanation is displayed in the right hand half of the window.

Context sensitive selection of online help pages is not possible.

Procedure

1. Generating HTML files
2. Generating a help book
3. Integrating the online help in SINUMERIK Operate
4. Saving help files

Other application cases

Online help for the following OEM-specific expansions can be created and used to supplement the SINUMERIK Operate online help system:

- Online help for **cycles and/or M functions** of the machine manufacturer which extend the programming options for SINUMERIK control systems. This online help is called in just the same way as the SINUMERIK Operate online help "Programming".
- Online help for OEM-specific **variables** of the machine manufacturer. This online help is called from the variable view of SINUMERIK Operate.

Programming online help

You can use the "SINUMERIK HMI programming package sl" for additional options for configuring the online help. Using this programming package, it is possible to develop high-level language applications in the C++ programming language for SINUMERIK Operate on the NCU 7x0.

Note

The "SINUMERIK HMI programming package sl" must be ordered separately as a software option. The associated documentation is provided together with the programming package.

17.2 Generating HTML files

Generating help files in the HTML format. It is possible to save all information in a single HTML file or to distribute the information over several HTML files.

You can assign the file names yourself, however, you must observe the following:

- References within HTML files should always be specified with relative paths. Only then can it be ensured that the references function in precisely the same way on both the development computer as well as on the target system.
- If jumps are to be made to certain points within an HTML file per link, then so-called anchors must be defined for this purpose.
  Example of an HTML anchor:
  ```
  <a name="myAnchor">This is an anchor</a>
  ```
- The contents of HTML documents must be saved with the UTF-8 coding. Only then is it guaranteed that the HTML documents are correctly displayed in all of the country languages supported by SINUMERIK Operate.
- The following sub-sets of the HTML functional scope are supported:

HTML tags

Tag	Description	Comment
a	Anchor or link	Supported attributes: href and name
address	Address	
b	Bold	
big	Larger font	
blockquote	Indented paragraph	
body	Document body	Supported attributes: bgcolor (#RRGGBB)
br	Line break	
center	Centered paragraph	
cite	Inline citation	Same effect as tag i
code	Code	Same effect as tag tt
dd	Definition data	
dfn	Definition	Same effect as tag i
div	Document division	The standard block attributes are supported
dl	Definition list	The standard block attributes are supported
dt	Definition term	The standard block attributes are supported
em	Emphasized	Same effect as tag i
font	Font size, family, color	Supported attributes: size, face, and color (#RRGGBB)
h1	Level 1 heading	The standard block attributes are supported
h2	Level 2 heading	The standard block attributes are supported
h3	Level 3 heading	The standard block attributes are supported
h4	Level 4 heading	The standard block attributes are supported
h5	Level 5 heading	The standard block attributes are supported
h6	Level 6 heading	The standard block attributes are supported

Tag	Description	Comment
head	Document header	
hr	Horizontal line	Supported attributes: width (can be specified as absolute or relative value)
html	HTML document	
i	Italic	
img	Image	Supported attributes: src, width, height
kbd	User-entered text	
meta	Meta-information	
li	List item	
nobr	Non-breakable text	
ol	Ordered list	The standard attributes for lists are supported
p	Paragraph	The standard block attributes are supported (default setting: left-aligned)
pre	Preformated text	
s	Strikethrough	
samp	Sample code	Same effect as tag tt
small	Small font	
span	Grouped elements	
strong	Strong	Same effect as tag b
sub	Subscript	
sup	Superscript	
table	Table	Supported attributes: border, bgcolor (#RRGGBB), cellspacing, cellpadding, width (absolute or relative), height
tbody	Table body	No effect
td	Table data cell	The standard attributes for table cells are supported
tfoot	Table footer	No effect
th	Table header cell	The standard attributes for table cells are supported
thead	Table header	This is used to print tables that extend over several pages
title	Document title	
tr	Table row	Supported attributes: bgcolor (#RRGGBB)
tt	Typewrite font	
u	Underlined	
ul	Unordered list	The standard attributes for lists are supported
var	Variable	Same effect as tag tt

Block attributes

The following attributes are supported by the tags div, dl, dt, h1, h2, h3, h4, h5, h6, p:

- align (left, right, center, justify)
- dir (ltr, rtl)

Standard attributes for lists

The following attributes are supported by tags ol and ul:

- type (1, a, A, square, disc, circle)

Standard attributes for tables

The following attributes are supported by tags td and th:

- width (absolute, relative, no-value)
- bgcolor (#RRGGBB)
- colspan
- rowspan
- align (left, right, center, justify)
- valign (top, middle, bottom)

CSS properties

The following table includes the supported CSS functional scope:

Property	Values	Description
background-color	<color>	Background color for elements
background-image	<uri>	Background image for elements
color	<color>	Foreground color for text
text-indent	<length>px	Indent the first line of a paragraph in pixels
white-space	normal | pre | nowrap | pre-wrap	Defines how whitespace characters are handled in HTML documents
margin-top	<length>px	Width of the upper edge of the paragraph in pixels
margin-bottom	<length>px	Width of the lower edge of the paragraph in pixels
margin-left	<length>px	Length of the left hand edge of the paragraph in pixels
margin-right	<length>px	Width of the righthand edge of the paragraph in pixels
vertical-align	baseline | sub | super | middle | top | bottom	Vertical alignment for text (in tables, only the values middle, top and bottom are supported)
border-color	<color>	Border color for text tables
border-style	none | dotted | dashed | dot-dash | dot-dot-dash | solid | double | groove | ridge | inset | outset	Border style for text tables
background	[<'background-color'> || <'background-image'>]	Short notation for background property
page-break-before	[auto | always]	Page break before a paragraph/table

Property	Values	Description
page-break-after	[auto | always]	Page break after a paragraph/table
background-image	<uri>	Background image for elements

Supported CSS selectors

All CSS 2.1 selector classes are supported with the exception of so-called pseudo selector classes such as :first-child, :visited and :hover.

17.3 Generating the help book

The help book is an XML file in which the structure of the online help is defined. In this file, you define:

- HTML documents
- Contents and subject index

Syntax for the help book

Tag	Number	Meaning	
HMI_SL_HELP	1	Root element of the XML document	
I-BOOK I I I I I I I I I I	+	Identifies a help book. The name can be freely selected under the constraint that no name predefined by the system is used (such as sinumerik_alarm_plc_pmc). In the example, the name of the help book is "hmi_myhelp" Attributes:	
		ref	Identifies the HTML document that is displayed as the entry page for the help book.
		title	Title of the help book that is displayed in the table of contents.
		helpdir	Directory that contains the online help of the help book.
I-ENTRY II II II II II II II II	*	Section of the online help Attributes:	
		ref	Identifies the HTML document that is displayed as entry page for the section.
		title	Title of the section that is displayed in the table of contents.
II-INDEX_ENTRY II II II II II II II II	*	Subject (keyword) to be displayed Attributes:	
		ref	Identifies the HTML document that is jumped to for this subject index entry.
		title	Title of the subject that is displayed in the subject index.

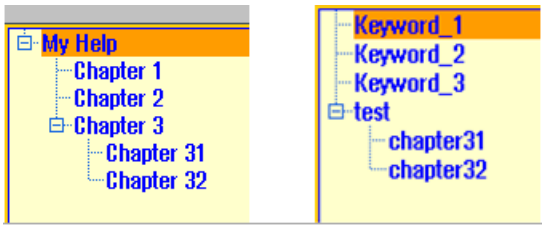
The following applies for the "Number" column:
* means 0 or more
+ means 1 or more

Example for a help book

In the following example, the structure of a help book with the "My Help" name is described. Further, it forms the basis for the table of contents and subject index.

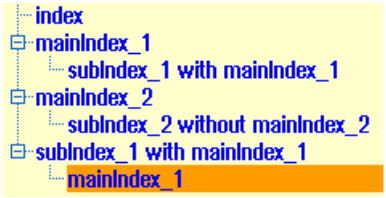
```
<?xml version="1.0" encoding="utf-8"?>
<HMI_SL_HELP language="en-US">
  <BOOK ref="index.html" title="My Help" helpdir="hmi_myhelp">
    <ENTRY ref="section_1.html" title="Section 1">
      <INDEX_ENTRY ref="section_1html#Keyword_1" title="Keyword_1"/>
      <INDEX_ENTRY ref="section_1.html#Keyword_2" title="Keyword_2"/>
    </ENTRY>
    <ENTRY ref="section_2.html" title="Section 2">
      <INDEX_ENTRY ref="section_2.html#Keyword_3" title="Keyword_3"/>
    </ENTRY>
    <ENTRY ref="section_3.html" title="Section 3">
      <ENTRY ref="section_31.html" title="Section 31">
        INDEX_ENTRY ref="section_31.html#test" title="test;section31"/>
      </ENTRY>
      <ENTRY ref="section_32.html" title="Section 32">
        INDEX_ENTRY ref="section_32.html#test" title="test;section32"/>
      </ENTRY>
    </ENTRY>
  </BOOK>
</HMI_SL_HELP>
```

The book comprises three sections, whereby the third section has two subsections. The various subject words (keywords) are defined within the section.



You have the following three options to format the subject index:

1. Single entry:
   `<INDEX_ENTRY ...title="index"/>`
2. Two two-stage entry, whereby each title has a main and a subentry. Separate the entries from one another using a comma.
   `<INDEX_ENTRY ...title="mainIndex_1,subIndex_1 with mainIndex_1"/>`
3. Two-stage entry, whereby the first title is the main entry and the second title is the subentry. Separate the entries from one another using a semicolon.
   `<INDEX_ENTRY ...title="mainIndex_2;subIndex_2 without mainIndex_1"/>`



17.4 Integrating the online help in SINUMERIK Operate

If you wish to integrate the generated help book into the online help system of SINUMERIK Operate, then you require the "slhlp.xml" file.

Format description of the "slhlp.xml"

Tag	Number	Meaning	
CONFIGURATION	1	Root element of the XML document. Designates that this involves a configuration file.	
I-OnlineHelpFiles	1	Introduces the section about the online help books.	
II-<help_book>	*	Introduces the section of a help book.	
III-EntriesFile III III III III III	1	File name of the help book with the list of contents and subject (keyword) entries. Attributes:	
		value	Name of the XML file
		type	Data type of the value (QString)
III-Technology III III III III III III III III III IIII	0,1	Specifies the technology that applies to the help book. "All" applies to all technologies. If the help book applies to several technologies, then the technologies are listed separated by comma. Possible values: All, Universal, Milling, Turning, Grinding, Stroking, Punching Attributes:	
		value	Technology data
		type	Data type of the value (QString)

Tag	Number	Meaning	
III -DisableSearch III III III III III	0,1	Disable the subject (keyword) search for the help book. Attributes:	
		value	true, false
		type	type, data type of the value (bool)
III-DisableFullTextSearch III III III III	0,1	Disable the full text search for the help book. Attributes:	
		value	true, false
		type	type, data type of the value (bool)
III-DisableIndex III III III III	0,1	Disable the subject index for the help book. Attributes:	
		value	true, false
		type	type, data type of the value (bool)
III-DisableContent III III III III	0,1	Disable the table of contents for the help book. Attributes:	
		value	true, false
		type	type, data type of the value (bool)
III-DefaultLanguage III III III III III	0,1	Abbreviation for the language that should be displayed if the actual country language is available for the help book. Attributes:	
		value	chs, deu, eng, esp, fra, ita, ...
		type	Data type of the value (QString)

The following applies for the "Number" column:
* means 0 or more

Example of a file "slhlp.xml"

The help book "hmi_myhelp.xml" is made known to SINUMERIK Operate in the following example.

The subject index has not been activated for the help book.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<!DOCTYPE CONFIGURATION>
<CONFIGURATION>
   <OnlineHelpFiles>
     <hmi_myHelp>
       <EntriesFile value="hmi_myhelp.xml" type="QString"/>
       <DisableIndex value="frue" type="bool"/>
     </hmi_myHelp>
   </OnlineHelpFiles>
</CONFIGURATION>
```

17.5 Saving help files

Saving help files in the target system

1. Open the /**oem**/sinumerik/him/hlp directory and create a new folder for the required language. For this purpose, use the specified language code.
   It is mandatory that the folder names are written in lower-case letters.
   For instance, if you are integrating a help function for German and English, then create the "deu" and "eng" folders.
2. Place the help book, e.g. "hmi_myhelp.xml" in the "deu" and "eng" folders.
3. Copy the help files into the directories, e.g. /**oem**/sinumerik/him/hlp/deu/hmi_myhelp for German and /**oem**/sinumerik/him/hlp/eng/hmi_myhelp for English help files.
4. Place the configuration file "slhlp.xml" into the directory /**oem**/sinumerik/hmi/cfg.
5. Restart the HMI.

Note

When displaying the list of contents and subject index of a help book, the help files are saved in the binary format (slhlp_<Hilfe-Buch_*.hmi) under the directory /siemens/sinumerik/sys_cache/hmi/hlp for faster use. If you change the help book, you must always delete these files.

See also

Supported languages (Page 513)

17.6 Generating online help for user alarms and machine data

You have the option to create a dedicated online help for user-specific PLC alarms. These can be opened context-sensitive from the alarm list when the alarms occur.

The help texts for the user-specific PLC alarms are realized in the HTML file "sinumerik_alarm_oem_plc_pmc.html".

Creating an HTML file

1. Create the HTML file in the following directory:
   /**oem**/sinumerik/hmi/hlp/<lng>/sinumerik_alarm_plc_pmc/ or
   /**user**/sinumerik/hmi/hlp/<lng>/sinumerik_alarm_plc_pmc/
   <lng> stands for the language code, e.g. deu, eng, etc. If you create a language directory, use the language code from the table in Section Supported languages (Page 513)
2. Assign the "sinumerik_alarm_oem_plc_pmc.html" name to the file. If you create help texts for several languages, then create the corresponding number of HTML files with precisely these names. This file name must not be changed and is applicable for all languages.
3. Place the files in the corresponding language directories. For instance, place the file for the German help text in the following directory:
   /**oem**/sinumerik/hmi/hlp/deu/sinumerik_alarm_plc_pmc/sinumerik_alarm_oem_plc_pmc.html
4. Delete the file "slhlp_sinumerik_alarm_plc_pmc_*.hmi" in the /**siemens**/sinumerik/sys_cache/hmi//hlp directory and restart the operating software.

"sinumerik_alarm_oem_plc_pmc.html" file

Entry	Meaning
AlarmNr	Hyperlink to the alarm number
.....	Help text for the corresponding alarm
<td width="85%">.....</td>	Text that is displayed after the "Explanation" or "Remedy" field.

Example

The alarm number is used as HTML anchor.

```
<?xml version="1.0" encoding="UTF-8"?><!DOCTYPE html PUBLIC "-//W3C//DTD
HTML 4.0 Transitional//EN" >
- <html>
   <head><title></title></head>
-  <body>
-    <table>
-      <tr>
-       <td width="15%">
          <b><a name="510000">510000</a></b>
        </td>
-       <td width="85%">
          <b>This is the help for user alarm 510000</b>
        </td>
      </tr>
-     <tr>
-       <td valign="top" width="15%">
          <b>Explanation</b>
        </td>
        <td width="85%"> This is the explanation of user alarm 510000.</td>
      </tr>
-     <tr>
        <td valign="top" width="15%"><b>Remedy:</b></td>
        <td width="85%">Eliminate reason for alarm. </td>
      </tr>
    </table>

   </body>
 </html>
```

Distribute the online help for user alarms over several HTML files

You have the option of distributing the online help for user alarms over several HTML files.

1. Create an XML file with the name "sinumerik_alarm_plc_pmc.xml" in the following directory: /**oem**/sinumerik/hmi/hlp/<lng>/ or /**user**/sinumerik/hmi/hlp/<lng>/
   <lng> stands for the language code, e.g. deu, eng, etc. When you create a language directory, use the language code from the table in Section Supported languages (Page 513)
2. Open the XML file and in the tag <NUM_AREAS> enter the number ranges of the alarms and the corresponding HTML files.
3. Store the HTML files, specified in the XML file, in the following directory: /**oem**/sinumerik/hmi/hlp/<lng>/sinumerik_alarm_plc_pmc or /**user**/sinumerik/hmi/hlp/<lng>/sinumerik_alarm_plc_pmc file

Example: Creating an XML file

Entry	Meaning
<BOOK>	Help book
<NUM_AREAS>	Number ranges of the alarms and the reference to the particular HTML file

In the following example are the online helps for the
alarms from 500000 to 599999 in the HTML file "sinumerik_alarm_oem_1.html",
the alarms from 600000 to 699999 in the HTML file "sinumerik_alarm_oem_2.html",
the alarms from 700000 to 799999 in the HTML file "sinumerik_alarm_oem_3.html",
the alarms from 800000 to 899999 in the HTML file "sinumerik_alarm_oem_4.html".

```
<?xml version="1.0" encoding="utf-8" standalone="yes"?>
  <!DOCTYPE HMI_SL_HELP>
  <HMI_SL_HELP>
   <BOOK>
     <NUM_AREAS>
       <NUM_AREA from="500000" to="599999" ref="sinumerik_alarm_oem_1.html"
       />
       <NUM_AREA from="600000" to="699999" ref="sinumerik_alarm_oem_2.html"
       />
       <NUM_AREA from="700000" to="799999" ref="sinumerik_alarm_oem_3.html"
       />
       <NUM_AREA from="800000" to="899999" ref="sinumerik_alarm_oem_4.html"
       />
     </NUM_AREAS>
   </BOOK>
  </HMI_SL_HELP>
```

Replacing the standard online help

You have the option of generating your own online help for the HMI and PLC alarms as well as machine data. This means that you can replace the standard online help by your own online help.

You can call your own online help directly at the controller using the INFO key. Instead of the standard online help, your own online help is displayed.

Directory for HTML files

Area	Directory
PLC alarms	/**oem**/sinumerik/hmi/hlp/<lng>/sinumerik_alarm_plc_pmc/ or /**user**/sinumerik/hmi/hlp/<lng>/sinumerik_alarm_plc_pmc/
HMI alarms	/**oem**/sinumerik/hmi/hlp/<lng>/sinumerik_alarm_hmi/ or /**user**/sinumerik/hmi/hlp/<lng>/sinumerik_alarm_hmi/
NC MD	/**oem**/sinumerik/hmi/hlp/<lng>/sinumerik_md_nck/
Channel MD	/**oem**/sinumerik/hmi/hlp/<lng>/sinumerik_md_chan/
Axis MD	/**oem**/sinumerik/hmi/hlp/<lng>/sinumerik_md_axis/

<lng> stands for the language code, e.g. deu, eng, etc. Only use the language codes from the table in SectionSupported languages (Page 513)

Procedure:

1. Create the corresponding directory, refer to the table "Directory for HTML files".
2. Generate the help file and as file names, use the alarm/machine data number as well as the extension ".html". If you create help texts for several languages, then create the corresponding number of HTML files with precisely these names and then create the file in the corresponding language directory.

Examples:

- Your own German online help for the PLC Alarm 510000:
  /oem/sinumerik/hmi/hlp/deu/sinumerik_alarm_plc_pmc/510000.html
- Your own German online help for the NC machine data 14510 $MN_USER_DATA_INT:
  /oem/sinumerik/hmi/hlp/deu/sinumerik_md_nck/14510.html

17.7 Example: This is how you create an online help for NC/PLC variables

Overview

In order to create context-sensitive online help for NC/PLC variables or system variables as shown in the following example, the descriptive texts are managed in language-dependent html files.

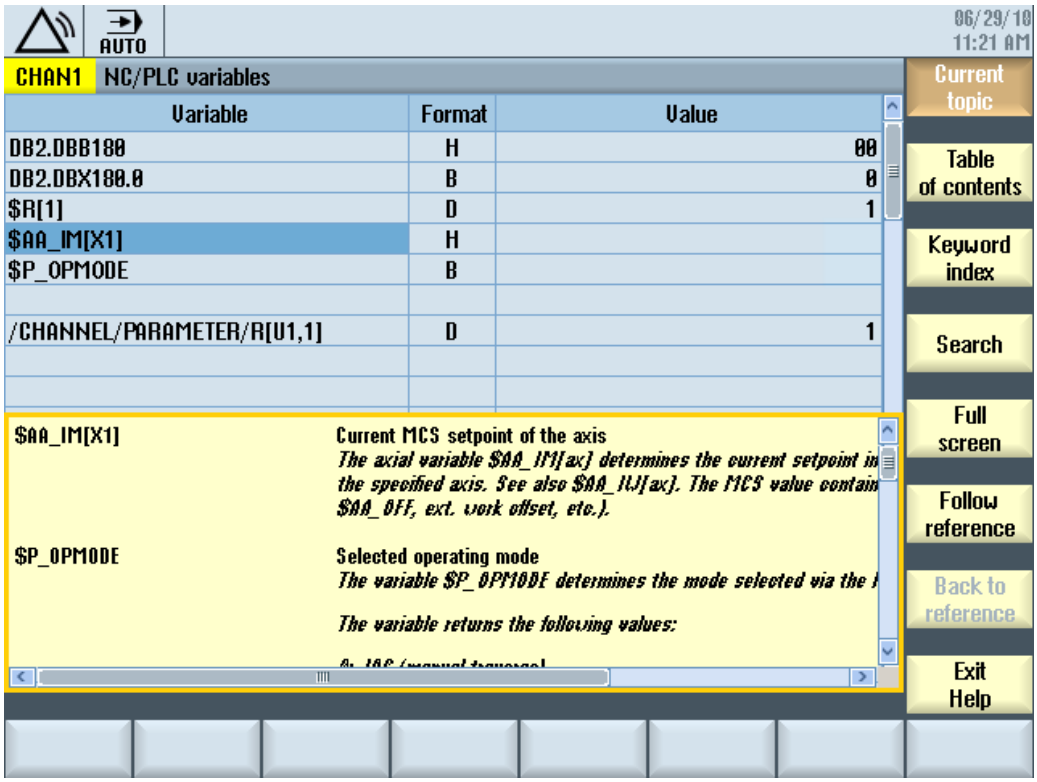


Figure 17-1 Example: Online help for user variables

Structure of the online help

The following files are required for the online help:

File	Meaning
sldgvarviewhelp.ini	Configuration file to manage an html file or several html files
<lng>/<name>1.html	The contents of all html files of the online help are language-dependent and are saved in the relevant language directory <lng>.
<lng>/<name>2.html	
. . .	
<lng>/<name>n.html	

Structure of the configuration file

The file is **independent of any language** and is structured as follows:

sldgvarviewhelp.ini

```
[HelpBindings]
/BAG/STATE/OPMODE = var1_help.html#var1
$AA_IM[X1] = var1_help.html
$R[1] = var1_help.html#var2
/Channel/Parameter/R[u1,1] = var2_help.html#var2
DB2.DBX180.0 = var2_help.html#var1
GUD/MyVar[2] = var2_help.html
```

Note

The html files can be generated with any html editor. A definition is provided in the configuration file as to which html files belong to the online help.

The description can comprise one or several html files: For example, one html file for each variable or several identical variables in one file.

Procedure:

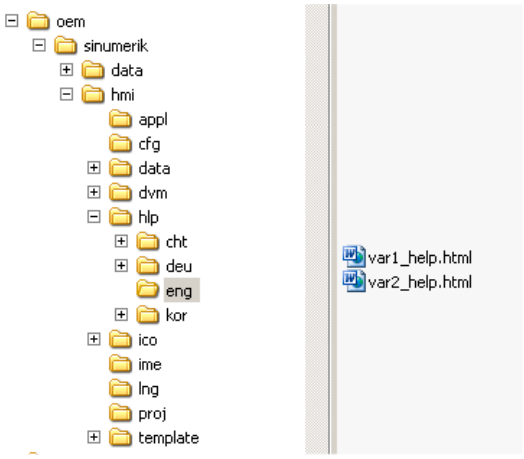
1. Copy the configuration file to the following directory:

   ```
   /oem/sinumerik/hmi/cfg/sldgvarviewhelp.ini
   ```

2. Copy the html files to one of the following directories:

   ```
   /oem/sinumerik/hmi/hlp/<lng>/
   /user/sinumerik/hmi/hlp/<lng>/
   ```

   <lng> stands for the language code.



3. Delete all files in the directory:

   ```
   /siemens/sinumerik/sys_cache/hmi//hlp
   ```

The settings become effective only after restarting the system.

17.8 Example: This is how you create a programming online help

Preconditions

Create the following files:

- Configuration file "prog_help.ini"

```
[milling]
CYCLE1=cycle1_help.html
CYCLE2=cycle2_help.html#TextAnchor1
CYCLE3=cycle3_help.html
CYCLE4=cycle4_help.html

[turning]
CYCLE3=cycle2_help.html
CYCLE4=cycle3_help.html
```

- Configuration file for the help book "slhlp.xml" (optional)

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<!DOCTYPE CONFIGURATION>
<CONFIGURATION>
  <OnlineHelpFiles>
    <hmi_prog_help>
      <EntriesFile value="hmi_prog_help.xml" type="QString"/>
      <DisableIndex value="true" type="bool"/>
    </hmi_prog_help>
  </OnlineHelpFiles>
</CONFIGURATION>
```

- Configuration file for the help book "hmi_prog_help.xml" (optional)

```
<?xml version="1.0" encoding="UTF-8"?>
```

```
<HMI_SL_HELP language="en-US">
  <BOOK ref="index.html" title="OEM_CYCLES" helpdir="hmi_prog_help">
    <ENTRY ref="cycle1_help.html" title="Cycle1"></ENTRY>
    <ENTRY ref="cycle2_help.html" title="Cycle2"></ENTRY>
    <ENTRY ref="cycle3_help.html" title="Cycle3"></ENTRY>
    <ENTRY ref="cycle4_help.html" title="Cycle4"></ENTRY>
    <ENTRY ref="cycle_help.html" title="OEM_Cycles"></ENTRY>
  </BOOK>
</HMI_SL_HELP>
```

- Language-dependent file "<prog_help_eng>.ts": this filename is permanently specified.

```
<?xml version="1.0" encoding="utf-8" standalone="yes"?>
<!DOCTYPE TS>
<TS>
     <context>
       <name>oem_cycles</name>
         <message>
           <source>CYCLE1</source>
           <translation>short description for cycle 1</translation>
           <chars>*</chars>
         </message>
         <message>
           <source>CYCLE2</source>
           <translation>short description for cycle 2</translation>
           <chars>*</chars>
         </message>
         <message>
           <source>CYCLE3</source>
           <translation>short description for cycle 3</translation>
           <chars>*</chars>
         </message>
     </context>
</TS>
```

Saving help files in the target system

Procedure:

1. Copy the configuration file "prog.ini" to the following directory:

   `/oem/sinumerik/hmi/cfg`

2. Copy the file "`slhlp.xml`" to the help book in the following directory:

   `/oem/sinumerik/hmi/cfg`

3. Create a directory for the desired language of the online help under the following path: `/oem/sinumerik/hmi/hlp/<lng>` and copy the `hmi_prog_help.xml` file there

   Use the specified language code from the list of language codes for file names. The directory names must be written in lower case.

4. Copy the language-dependent `prog_help_<lng>.ts` file for the Product Brief to the following path: `/oem/sinumerik/hmi/<lng>/prog_help_<lng>.ts`

5. Copy the html files with the description of the OEM cycles to the following directory:

   `/oem/sinumerik/him/hlp/<lng>/hmi_prog_help/cycle<n>_help.html`

The settings become effective only after restarting the system.

Activating ePS Network Services

18

Precondition

To start the "ePS Network Services" software, configure a softkey using a display machine data. To do this you require, as a minimum, authorization for access level 3 (user).

Configuring a softkey

MD9108 $MM_ENABLE_EPS_SERVICES	
= 1	"ePS Network Services" softkey is displayed on the extended user interface bar.

References

Information on the software can be found in the following documentation:

Function Manual ePS Network Services

Safety Integrated 19

19.1 Displaying machine data and parameters

19.1.1 View of the axes

You can display the Safety Integrated axes in the "Machine Configuration" window.

Copying and confirming Safety Integrated data

You can copy and confirm Safety Integrated data.

Activating and deactivating the start-up of the Safety Integrated drives

You have the possibility of activating and deactivating Safety Integrated drives.

The Safety commissioning mode in the drives is activated.

References

Further information is available in the Safety Integrated 840D sl Function Manual

Procedure

1. Select the "Start-up" operating area.

2. Press the menu forward key and the "Safety" softkey.
   The "Machine Configuration Safety Axes" window opens.

All of the safety axes are displayed.

3. Press the "All axes" softkey if you wish to display all of the axes.

   The "All Axes Machine Configuration" window opens and the "All axes" softkey changes into "Safety axes".

4. Press the "Safety axes" softkey in order to return to the view of the safety axes.

See also

Copying and confirming Safety Integrated data (Page 369)

Activating/deactivating start-up mode (Page 370)

Displaying the Safety-Integrated settings (Page 371)

19.1.2 General machine data for Safety Integrated

The general machine data is listed in the "Selection of General MD" window and can be edited, copied and confirmed.

Note

Changes as well as copying and confirming are effective for all axes and the general machine data.

Screen view

The machine data display is split into two halves:

- In the upper part of the screen view, the machine data that are important for commissioning are displayed; however, they do not involve Safety Integrated machine data.
- Safety Integrated machine data are displayed in the lower part of the screen view.

Changing the screen view

1. Press the "MD selection" to change into the full screen view.
   The selection of general machine data is displayed over the complete screen.

2. Press the "SI-MD" softkey.
   The general safety integrated machine data are displayed over the full screen.

3. Press the "SI + MD selection" softkey.
   You return to the common view split in two of the general machine data and the Safety Integrated machine data.

Searching for machine data

1. Press the "Search" softkey, enter the machine data number being searched for in the window that opens or a character string that is being searched for an press the "OK" softkey.

2. Press the "Continue search" softkey if the text position found does not correspond to the required machine data.

3. Press the "Go to start" or "Go to end" softkey to set the cursor to the beginning or to the end of the displayed data.

4. Press the "Search" softkey if you wish to change the search term.

19.1.3 Axis-specific machine data in Safety Integrated

The axis machine data is listed in the "Axis MD" window and can be changed.

Copying and confirming Safety Integrated data for certain axes

Select the desired axis using the "Axis +" or "Axis -" softkey for which the Safety Integrated data is to be copied and confirmed.

Screen view

The machine data display is split into two halves:

- In the upper part of the screen view, the machine data that are important for commissioning are displayed; however, they do not involve Safety Integrated machine data.
- Safety Integrated machine data are displayed in the lower part of the screen view.

Changing the screen view

1. Press the "MD selection" to change into the full screen view.
   The selection of Axis MD is displayed over the complete screen.

2. Press the "SI-MD" softkey.
   The Safety Integrated Axis MD are displayed over the complete screen.

3. Press the "SI + MD selection" softkey.
   You return to the common view split in two of the general machine data and the Safety Integrated machine data.

Searching for machine data

1. Press the "Search" softkey, enter the machine data number being searched for in the window that opens or a character string that is being searched for an press the "OK" softkey.

2. Press the "Continue search" softkey if the text position found does not correspond to the required machine data.

3. Press the "Go to start" or "Go to end" softkey to set the cursor to the beginning or to the end of the displayed data.

4. Press the "Search" softkey if you wish to change the search term.

19.1.4 Drive machine data in Safety Integrated

The drive machine data is listed in the "Selection of Drive MD" window and can be changed.

Activating or deactivating the startup mode

Use the "Drive +" or "Drive -" softkey to select the drive that you want to switch to startup mode.

Searching for machine data

1. Press the "Search" softkey, enter the machine data number being searched for in the window that opens or a character string that is being searched for an press the "OK" softkey.

2. Press the "Continue search" softkey if the text position found does not correspond to the required machine data.

3. Press the "Go to start" or "Go to end" softkey to set the cursor to the beginning or to the end of the displayed data.

4. Press the "Search" softkey if you wish to change the search term.

19.1.5 Copying and confirming Safety Integrated data

All the NC machine data relevant for the SI functions is transferred to the corresponding drive parameters.

The SI machine data or drive parameters to define the encoder mounting arrangement must be separately entered for the NCK and drive. These are not copied

Note

Certain NCK machine data are not copied into the drive parameters.

When confirming the data, the actual check sum is saved in the reference check sum.

Note

The data is saved for all safety axes.

Precondition

The "Machine configuration" window is open.

Procedure

Copying Safety Integrated data

1. Press the "Copy SI data" and "OK" softkeys. Safety-oriented NCK machine data are copied into the drive parameters.

2. Press the "Axis MD" softkey and select an axis using the "Axis +" or "Axis -" softkey if you wish to copy axis-specific machine data and safety data.

3 Press the "Reset (po)" and "OK" softkeys.
The control and the drives restart (warm restart).

Confirming Safety Integrated data

4. Press the "Confirm SI data" and "OK" softkeys.
   The correctness of the values is confirmed and the current checksum saved.
   The drive data is saved automatically

19.1.6 Activating/deactivating start-up mode

For the start-up of the Safety Integrated drives, the drive parameter p0010 is switched to startup mode (p0010=95).

Value "0" is entered in drive parameter p0010 to exit the start-up mode. Beforehand, the CRC in p9798 and p9898 are confirmed. The start-up state can be exited with or without saving.

At the same time, you can set the drive PROFIsafe address.

Procedure

1. Select the "Startup" operating area.

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

3. Press the "Drive MD" softkey and select the desired drive using the "Drive +" or "Drive -" softkey.

   - OR -

...

Press the "View axes" softkey.

4. Press the "Deactivate dr. start-up" softkey.
   A prompt is displayed.

5. Press the "OK" softkey to continue with the start-up.
   A prompt is displayed whether you want to set the PROFISafe address for the selected drive.

6. Press the "Yes" softkey.
   Already existing settings of parameter p9810 are overwritten and the drive parameter p0010 is switched to the start-up mode.
   - OR -

   Press the "No" softkey.
   The existing settings of parameter p9810 are retained and the drive parameter p0010 is switched to the start-up mode.

7. Press the "Deactivate dr. start-up" softkey.

19.1.7 Displaying the Safety-Integrated settings

The following configured values can be displayed in the "Safety Integrated Settings" window:

- Safe operating stop and safely limited speed (SBH/SG)
- Safe software end position for software limit switches (SE)
- Safe cams (SN)

You can use the softkeys to scroll between the Safety Integrated axes.

Procedure

1. Select the "Startup" operating area.

2. Press the menu advance key and the "Safety" softkey.

3. Press the "View settings" softkey.
   The "Safety Integrated Settings" window opens.
   The configured limits for safe operating stop (SBH) and safely limited speed (SG) are displayed.

4. Press the "Show safe limit pos." softkey if you wish to display the configured directions and limits of the software limit switches (SE).

5. Press the "Show Safe Cams" softkey if you wish to display the positions and assignments of the safe cams (SN).

See also

View of the axes (Page 365)

19.2 Safety Integrated diagnostics

19.2.1 Status display for NCK Safety Integrated

The status display shows signals or values with NCK and drive information for a selected axis.

Available signals

- Safe actual position
- Position deviation NCK/drive
- "Safe operating stop" monitoring active
- "Safe velocity" monitoring active
- Active SV step
- Active SV correction factor
- Safe actual velocity limit
- Set velocity limit
- Current velocity difference
- Maximum velocity difference
- Active safe software limit switch
- Active gear ratio (step)
- Active stop
- Currently requested external stop
- Stop F code value
- Pulses enabled
- Traversing inhibit, stop in other axis

Procedure

1. Select the "Diagnostics" operating area.

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

3. Press the "SI status" softkeys.
   The "Safety Integrated Status (NCK)" window appears.

...

4. Press the "Axis +" or "Axis -" softkey.
   The values of the next or the previous axis are displayed.
   - OR -

Press the "Axis selection" softkey and select the desired axis directly from the displayed list of available axes.

19.2.2 Display SGE/SGA signals

Safety-related inputs and outputs

SGE
Safe input signals, NCK Bit15...0
Safe input signals, drive Bit15...0
Safe input signals, NCK, Bit 16...31
Safe input signals, drive, Bit 16...31
SGA
Safe output signals, NCK Bit15...0
Safe output signals, drive Bit15...0
Safe output signals, NCK, Bit 16...31
Safe output signals, drive, Bit 16...31

Procedure

1. Select the "Diagnostics" operating area.

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

3. Press the "SGE/SGA" softkey to display the safety-related input and output signals.
   The "Safety Integrated SGE/SGA" window appears.

4. Press the "Axis +" or "Axis -" softkey.
   The values of the next or the previous axis are displayed.

- OR -

Press the "Axis selection" softkey and select the desired axis directly from the displayed list of available axes.

19.2.3 Display SPL signals

Safe programmable logic

Variables

$A_INSE (P)	$A_INSE (P) - corresponds to simultaneous selection of: $A_INSE (upper line, origin of the NCK) and $A_INSEP (lower line, origin of the PLC)
$A_OUTSE (P)	comp. $A_INSE (P)
$A_INSI (P)	comp. $A_INSE (P)
$A_OUTSI (P)	comp. $A_INSE (P)
$A_MARKERSI (P)	comp. $A_INSE (P)
$A_PLCSIIN	comp. $A_INSE (P)
$A_PLCSIOUT	comp. $A_INSE (P)

Bit Selection of an 8-bit area of the selected signal.

Available signals/values

DCC fill level
DCC status
DCC control word
SPL booting state
SPL started up
SPL interfaces have been parameterized
SPL program file SAFE.SPL loaded
NCK and PLC state
Interrupt for PLC start should be assigned
Interrupt has been assigned for PLC start
Interrupt processing for SPL start called
Interrupt processing for SPL start terminated
SPL start implemented using PROG_EVENT mechanism
SPL started via AUTO start
SPL processing completed, end of program reached.
NCK data cross-checking (DCC) has been started
PLC data cross-checking has been started
Cyclic SPL checksum test active
All SPL protective mechanisms active

Procedure

1. Select the "Diagnostics" operating area.

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

3. Press the "SPL" softkey to display the safe programmable logic signals.
   The "Safety Integrated SPL" window is opened

19.2.4 Displaying Safety Integrated checksums

You obtain the following information areas in the "SI Configuration" window:

- Overview of the settings of the Safety Integrated option
- Tables indicate the checksum for the actual Safety Integrated configuration.

Safety Integrated options

The overview of the Safety Integrated options includes the number of the Safety Integrated axes configured as well as an overview of the active Safety Integrated options.

Safety Integrated checksum area

The following checksums are displayed for the overview of the Safety Integrated checksum area:

- Checksum for the "SAFE.SPF" program
- General checksums
- Checksum for NCK and drive for each axis and the corresponding drive, for which the Safety Integrated has been enabled.

  You receive information about the time of the last change of the checksum in the NCK.

Procedure

1. Select the "Diagnostics" operating area.

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

3. Press the "SI checksum" softkey.
   The "SI Configuration" window opens.

4. Press the "Axis +" or "Axis -" softkey.
   The values of the next or the previous axis are displayed.

...

- OR -

Press the "Axis selection" softkey and select the desired axis directly from the displayed list of available axes.

19.2.5 Safety Integrated Basic Functions (Drive)

Supported functions

The following Safety Integrated functions (Safety Integrated Basic Functions) are available: These functions are available in the standard drive version.

- **Safe Torque Off (STO)**

  STO is a safety function that prevents the drive from restarting unexpectedly in accordance with EN 60204-1.

- **Safe Stop 1 (SS1, time controlled)**

  The SS1 function is based on the “Safe Torque Off” function. This means that a Category 1 stop in accordance with EN 60204-1 can be implemented.

- **Safe Brake Control (SBC)**

  The SBC function permits the safe control of a holding brake.

Note

Safety Integrated Basic Functions

When a drive object that has Safety Integrated functions released is switched to "Parking" state, the Safety Integrated software responds by activating STO without generating a separate message.

References

The functions are described in: Function Manual Safety Integrated /FBSIsl/

Procedure

1. Select the "Diagnostics" operating area.

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

3. Press the "SI status" softkey.
   The "SI status" window is opened.

4. Press the "Display drive status" softkey to display the status of safe drives.

5. Press the "Drive +" or "Drive -" softkey.
   The parameters are displayed for the next or previous drive object.

...

- OR -

6. Press the "Drive selection" softkey and in the drop-down list that appears, directly select the desired drive object.

19.2.6 Safety Integrated fail-safe I/O

Fail-safe I/O modules ("fail-safe modules")

The "SI I/O" display provides a summary of the configuration and status of the PROFIsafe I/O. The following signals are displayed:

- Fail-safe master address
- Parameterized PROFIsafe cycle time
- Maximum occurring PROFIsafe cycle time
- Modular PROFIsafe I/O interface
- Number of active I/O modules
- Number of passive I/O modules

Procedure

1. Select the "Diagnostics" operating area.

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

3. Press the "SI I/O" softkey.
   The "SI I/O" window is opened and the status of the signals is displayed.

Press the "Fail-safe modules" softkey to display the status of the fail-safe modules and their PROFIsafe address.

4. Press the "Details" softkey to display further information on this fail-safe module.

19.2.7 Displaying cam signals

The signals of the cam SGA are displayed in the "Cam SGA" window.

Cam synchronization is executed between NCK and PLC at the cam SGA.

Procedure

1. Select the "Diagnostics" operating area.

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

3. Press the ">>" and "Cam SGA" softkeys.
   The "Cam SGA" window is opened.

4. Press the "Axis +" or "Axis -" softkey.
   The values of the next or the previous axis are displayed.

   - OR -

   Press the "Axis selection" softkey and select the desired axis directly from the displayed list of available axes.

19.2.8 Displaying SI communication data

Signals and values for the following communication data are displayed in the "SI Communication (General)" window:

- Parameterized CPU-CPU communication clock cycle status
- Actual CPU-CPU communication clock cycle status
- Maximum CPU-CPU communication clock cycle
- Number of active send data connections (F_SENDDP)
- Number of active receive data connections (F_RECVDP)

Procedure

1. Select the "Diagnostics" operating area.

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

3. Press the ">>" and "SI communication" softkeys.

The "SI Communication (General)" window opens.

19.2.9 SI communication send connections

The configuration as well as the status of F_SENDDP are displayed in the SI communication (send)" window.

Displayed signals

The following signals of the selected connection are displayed:

- CPU-CPU communication ID
- Logical base address
- Connection number
- Maximum parameterized communication time

- Actual communication time
- Maximum communication time
- Error reaction

  Error reactions that can be set:
  - [0] "Alarm 27350 + STOP D/E"
  - [1] "Alarm 27350"
  - [2] "Alarm 27351 (self clearing)"
  - [3] "No reaction"
- Error
- Diagnostics error code
- Substitute values active
- Actual communication data
- Driver state

  Status display:
  - [0] "Not initialized"
  - [1] "Establish communication after booting"
  - [2] "Establish communication after error"
  - [3] "Wait for checkback signals SN=1"
  - [4] "Receiver waits for user acknowledgement"
  - [5] "Normal operation"

Procedure

1. The "SI communication (general)" window with the communication data is opened.

2. Press the "Send connection" softkey.

   The "SI communication (send)" window is opened.

3. Press the "Connection +" or "Connection -" softkey to select the connection whose data you wish to display.

4. Press the "Display SPL connection" softkey in order to display additional details, e.g. connection data that has been set.

   The softkey is only available if send connections have been configured.

5. Press the "Display connection" softkey to return to the window with the send connections of the selected connection.

19.2.10 SI communication receive connections

The configuration as well as the status of F_ RECVDP are displayed in the SI communication (receive)" window.

Displayed signals

The following signals of the selected connection are displayed:

- CPU-CPU communication ID
- Logical base address
- Connection number
- Maximum parameterized communication time
- Actual communication time
- Maximum communication time
- Error reaction

  Error reactions that can be set:
  - [0] "Alarm 27350 + STOP D/E"
  - [1] "Alarm 27350"
  - [2] "Alarm 27351 (self clearing)"
  - [3] "No reaction"
- Error
- Diagnostics error code
- Substitute values active
- Substitute values
- Actual communication data
- Driver state

  Status display:
  - [0] "Not initialized"
  - [1] "Establish communication after booting"
  - [2] "Establish communication after error"
  - [3] "Wait for checkback signals SN=1"
  - [4] "Receiver waits for user acknowledgement"
  - [5] "Normal operation"
- Request user acknowledgement
- Sender in the deactivated safety mode

Procedure

1. The "SI communication (general)" window with the communication data is opened.

2. Press the "Receive connection" softkey.
   The "SI communication (send)" window is opened.

3. Press the "Connection +" or "Connection -" softkey to select the connection whose data you wish to display.

4. Press the "Display SPL connection " softkey to display additional details, e.g. connection data that has been set.
   The softkey is only available if send connections have been configured.

5. Press the "Display connection" softkey to return to the window with the receive connections of the selected connection.

Configuring cycles 20

20.1 Activating turning/milling/drilling technologies

The cycles are automatically loaded when the controller boots (Power On).

The configuration is realized using cycle machine data and cycle setting data. In so doing, a differentiation is made between the following data:

- General cycle machine data
- Channel-specific cycle machine data
- Axis-specific cycle machine data
- General cycle setting data
- Channel-specific cycle setting data
- Axis-specific cycle setting data

Adapting the user interface

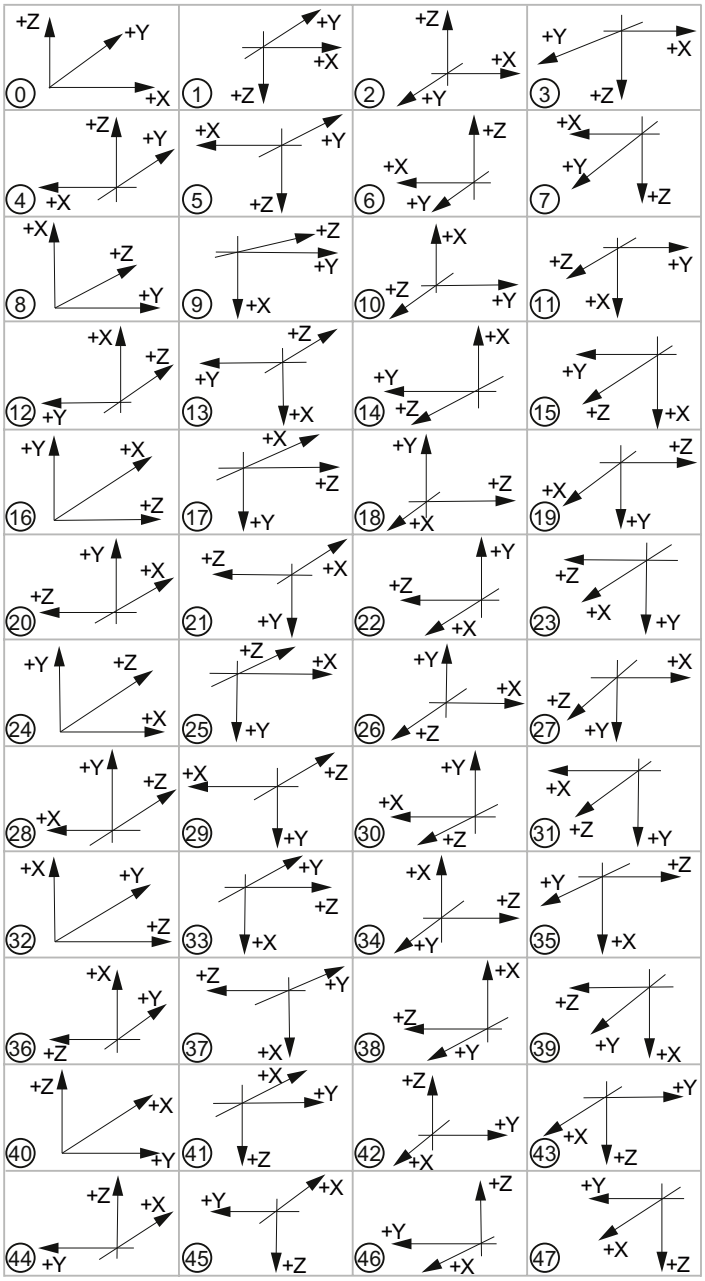
The softkey display for the selection of the cycle support in the program editor is set using the following channel-specific configuration machine data.

MD52200 $MCS_TECHNOLOGY	Technology
= 1	Setting for turning
= 2	Setting for milling

Setting the coordinate system

MD52000 $MCS_DISP_COORDINATE_SYSTEM	Position of the coordinate system
= 0	Default setting
With this machine data you adapt the position of the coordinate system to the machine. This change also automatically influences the following settings: • Help screens • Sequence graphics • Simulation • Input fields with circle direction data	

The following settings can be selected for the coordinate system:



Meaning of the axes

MD52206 $MCS_AXIS_USAGE[n]	Meaning of the axes in the channel [n] channel axis number
= 0	No special meaning
= 1	Tool spindle (driven tool)
= 2	Auxiliary spindle (driven tool)
= 3	Main spindle (turning)
= 4	Separate C axis of the main spindle (turning)
= 5	Counterspindle (turning)
= 6	Separate C axis of the counterspindle (turning)
= 7	Linear axis of the counterspindle (turning)
= 8	Tailstock (turning)
= 9	Back rest (turning)
= 10	B axis (turning)

Defining the direction of rotation

Enter the direction of rotation for the rotary axes that are not configured in a toolholder or a 5-axis transformation via the following channel-specific machine data:

MD52207 $MCS_USAGE_ATTRIB[n]	Attribute of the axes in the channel [n] channel axis number
Bit 0	Rotation around 1st geometry axis (for rotary axes)
Bit 1	Rotation around 2nd geometry axis (for rotary axes)
Bit 2	Rotation around the 3rd geometry axis (for rotary axes)
Bit 3	Direction of rotation is counter-clockwise (for rotary axis / C axis).
Bit 4	Displayed direction of rotation of the spindle/C axis for the M function M3 is counter-clockwise
Bit 5	Inverts M3 / M4 (for spindles) This bit must be set analog to PLC bit DBnn.DBX17.6! (nn = 31 + Machine axis index)

Additional settings

MD52201 $MCS_TECHNOLOGY_EXTENSION	Technology extension for combined machines with several technologies
= 1	Additional settings for turning
= 2	Additional settings for turning, e.g. lathe with milling technology MD52200 $MCS_TECHNOLOGY = 1 MD52201 $MCS_TECHNOLOGY_EXTENSION = 2

MD52005 $MCS_DISP_PLANE_MILL	Plane selection G17, G18, G19
= 0	Milling: Plane selection in the cycle support when programming under "programGUIDE G code"
= 17	G17 plane (default value)
= 18	G18 plane
= 19	G19 plane

MD52006 $MCS_DISP_PLANE_TURN	Plane selection G17, G18, G19
= 18	G18 plane (permanently set)

MD52212 $MCS_FUNCTION_MASK_TECH	Cross-technology function mask
Bit 0	Enable swivel
= 0	Swivel plane, swivel tool not enabled
= 1	Swivel plane, swivel tool enabled
Bit 1	No optimized travel along software limit switches
= 0	No optimized travel along software limit switches
= 1	Optimized travel along software limit switches
Bit 2	Approach logic for stepped drill (ShopTurn)
Bit 3	Call block search cycle for ShopMill/ShopTurn
= 0	The E_S_ASUP or F_S_ASUP cycles are not called in the block search cycle PROG_EVENT.SPF
= 1	The E_S_ASUP (under ShopMill) or F_S_ASUP (under ShopTurn) cycles are called in the block search cycle PROG_EVENT.SPF
Bit 4	Approach logic using the cycle (ShopTurn)
Bit 5	The cycle for SERUPRO (CYCLE207) is called in the block search cycle PROG_EVENT.SPF
Bit 6	Zero offset value ZO cannot be entered (ShopTurn)

MD52240 $MCS_NAME_TOOL_CHANGE_PROG	Tool change program for G code steps
= Program name	The associated program is called for tool change.

See also

Technology cycles for swiveling (Page 424)

20.2 Technology cycles for drilling

Drilling technology

You can set drilling technology using the following channel-specific configuration machine data and channel-specific cycle setting data.

MD52216 $MCS_FUNCTION_MASK_DRILL	Drilling function mask
Bit 0	Tapping cycle CYCLE84, technology input fields
= 0	Hide input fields
= 1	Display input fields
Bit 1	Tapping cycle CYCLE840, technology input fields
= 0	Hide input fields
= 1	Display input fields

SD55216 $SCS_FUNCTION_MASK_DRILL_SET	Drilling function mask
Bit 0	Tapping CYCLE84, determine spindle direction of rotation in the cycle
= 0	Do not reverse spindle direction of rotation
= 1	Reverse spindle direction of rotation
Bit 1	Boring CYCLE86 Note: Spindle direction of rotation M3/ M4 and direction of rotation of the rotary axes must be set according to DIN. For SPOS=0, the tool cutting edge points in the + direction of the 1st axis of the plane (for G17, to X+).
= 0	Do not take into account the rotation of the tool plane when positioning the spindle (SPOS).
= 1	Take into account the rotation of the tool plane when positioning the spindle (SPOS).
Bit 2	Boring CYCLE86
= 0	When positioning the spindle, do not take into account the components of the swiveled table kinematics (swiveling with CYCLE800, tool carrier). Note: Only the rotary axis of the machine kinematics that rotates the workpiece is taken into account. In the initial state of the kinematics, this rotary axis must be orientated parallel to the tool axis. e.g. rotary axis C rotation around Z (for G17) rotary axis vector of the swivel data set V2xyz = 0 , 0 , -1.
= 1	When positioning the spindle, take into account the components of the swiveled table kinematics (swiveling with CYCLE800, tool carrier).
Bit 4	Tapping CYCLE840, set monitoring of the machine data MD31050 $MA_DRIVE_AX_RATIO_DENOM and MD31060 $MA_DRIVE_AX_RATIO_NUMERA of the spindle
= 0	No monitoring
= 1	Monitoring
Bit 5	Tapping CYCLE84: Calculation of the brake application point for G33

Tapping (CYCLE84 and CYCLE840)

If the technology screens are hidden using the channel-specific configuration machine data MD52216 $MCS_FUNCTION_MASK_DRILL, then the settings in the following channel-specific cycle setting data are effective:

SD55481 $SCS_DRILL_TAPPING_SET_GG12[0]	Exact stop response
= 0	Exact stop response as before the cycle call (default value).
= 1	G601
= 2	G602
= 3	G603

SD55482 $SCS_DRILL_TAPPING_SET_GG21[0]	Acceleration behavior
= 0	Acceleration behavior as before the cycle call (default value).
= 1	SOFT
= 2	BRISK
= 3	DRIVE

SD55483 $SCS_DRILL_TAPPING_SET_GG24[0]	Feedforward control
= 0	Precontrol, the same as before the cycle call (default value).
= 1	FFWON
= 2	FFWOF

For settings under ShopTurn, please refer to Chapter Drilling centered under ShopTurn (Page 506)

Tapping (CYCLE84)

SD55484 $SCS_DRILL_TAPPING_SET_MC[0]	Spindle operation for MCALL
= 0	For MCALL, reactivate spindle operation (default value).
= 1	For MCALL, remain in position controlled spindle operation.

20.3 Manufacturer cycles

20.3.1 Manufacturer cycles

The following cycles are also available in the cycle package for individual adaptation:

CUST_TECHCYC.SPF	Manufacturer cycle for the adaptation of technology cycles.
CUST_800.SPF	Manufacturer cycle for the adaptation of the Swivel plane and the Swivel tool functions (CYCLE800).
CUST_832.SPF	Manufacturer cycle for the adaptation of the High Speed Settings function (CYCLE832).
CUST_MEACYC.SPF	Manufacturer cycle for the adaptation of the measuring functions.
PROG_EVENT.SPF	Standard cycle to support the following functions: • Block search when milling or turning is activated • Block search and swivel plane • Block search and align / advance tool Observe MD52212 $MCS_FUNCTION_MASK_TECH bit 3 and bit 5.
CUST_T	Cycle is used to track the T preparation after SERUPRO.
CUST_M6	Cycle is used to track the tool change after SERUPRO.
CUST_MULTICHAN	Manufacturer cycle for lathes with several channels

Copying manufacturer cycles

1. Select the "Start-up" operating area.

2. Press the "System data" softkey.

3. Open the directory NC data/Cycles/Standard cycles and select the manufacturer cycles.

4. Press the "Copy" softkey and open the NC data/Cycles/Manufacturer cycles directory.

5. Press the "Paste" softkey.
   The cycles are available for you to individually adapt them.

Extending the PROG_EVENT standard cycle

If you wish to extend the functionality of the PROG_EVENT, then you must not copy this into the manufacturer cycles directory, but you must create two new manufacturer cycles. Use the names CYCPE1MA.SPF or CYCPE_MA.SPF names for the manufacturer cycles.

For the manufacturer cycles CYCPE1MA.SPF or CYCPE_MA.SPF, the corresponding

jump markers are prepared at the beginning and at the end of PROG_EVENT.SPF.

If the CYCPE1MA.SPF and CYCPE_MA.SPF manufacturer cycles are created in the NC, the program correspondingly branches from PROG_EVENT to the manufacturer cycles.

1. Select the "Start-up" operating area.

2. Press the "System data" softkey.
3. Select the directory /NC data/Cycles/Manufacturer cycles

4. Press the "New" softkey.
   The "New G Code Program" window opens.
5. Assign the name CYCPE1MA or CYCPE_MA.
   Only use these names.

6 Press the "OK" softkey.
   The cycle has been created and you can now adapt it.

20.3.2 Manufacturer cycle for tool change CUST_T and CUST_M6

Function

The two cycles are used to track the T preparation (CUST_T) and the tool change (CUST_M6) according to SERUPRO. In so doing, depending on the specific toolholder, the following is output:

- Last programmed change
- Last programmed preparation

Precondition

The cycles can only be used when tool management is active.

Sequence

The two cycles are called in the "SERUPRO-END-ASUB", which also provides the two transfer parameters.

Parameter	Meaning
_THnr	Toolholder or master spindle number that was programmed for the change or the preparation.
_MTHnr	Number of the active toolholder or master spindle at the time of programming.

The cycles themselves do not contain and "machine logic". Pure data operations are performed.

The active toolholder or the master spindle is saved.

Using the transfer parameter, the situation at the time of the T or M6 programming is determined. This situation is established, T and/or M06 output or a branch is made into the manufacturer cycles. After the output of T and M06 or after returning from the manufacturer cycles, the toolholder, saved at the beginning, is reactivated.

The cycles have additionally commented jump-out positions for change or preparation cycles of the manufacturer. A change cycle can then only be called without any restriction, if the corresponding queries such as program test, block search,...exist.

T replacement cycle

If a T replacement cycle is being used, then the following note must be observed:

Note

The CUST_T cycle uses the language command TCA (ToolChangeAbsolut) for the T call and therefore also has the possibility of inserting tools that have been disabled. However, this language command cannot be substituted.

The following must be observed if working at a machine with T replacement:

- The T preparation cycle must be explicitly called at the specified position.
- If the call is realized using the CUST_T cycle, then the parameter evaluation ($C_TS_PROG, …) is skipped.
  Alternatively, the original TCA language command can be reprogrammed.

References

For more information, please refer to the Function Manual, Basic Functions, Chapter: SERUPRO-End-ASUB

20.3.3 CUST_TECHCYC.SPF manufacturer cycle

Preparation

Function markers (_M1 to _M153) are prepared and documented in the CUST_TECHCYC.SPF cycle. If you wish to adapt the cycle, proceed as follows:

1. Copy the CUST_TECHCYC.SPF cycle from the directory:
   /NC data/cycles/standard cycles
2. Insert the CUST_TECHCYC.SPF cycle into the directory:
   /NC data/cycles/manufacturer cycles

Adapt manufacturer cycle CUST_TECHCYC.SPF

You can execute the following actions with the aid of the _MODE parameter:

Marker	Action	
_M1	Main spindle:	Changeover to C axis mode
_M2		Changeover to spindle mode
_M3		Clamp C axis
_M4		Release C axis clamping
_M5		Rinse chuck
_M6		Close chuck
_M7		Open chuck when spindle is stationary
_M8		Open chuck when spindle is rotating
_M11	Tool spindle:	Changeover to C axis mode
_M12		Changeover to spindle mode
_M13		Clamp C axis
_M14		Release C axis clamping
_M21	Counterspindle:	Changeover to C axis mode
_M22		Changeover to spindle mode
_M23		Clamp C axis
_M24		Release C axis clamping
_M25		Rinse chuck
_M26		Close chuck
_M27		Open chuck when spindle is stationary
_M28		Open chuck when spindle is rotating
_M29		Rinse chuck off
_M30	Position 4th axis after block search (e.g. counterspindle, tailstock, back rest)	
_M41	Engage driven tool	

Marker	Action	
_M42	Disengage driven tool	
_M61	Changeover to turning	
_M62	Changeover to peripheral surface machining C	
_M63	Changeover to face machining C	
_M64	Changeover to peripheral surface machining Y	
_M65	Changeover to face machining Y	
_M66	Changeover to face machining B (swivel)	
_M67	Deselection of the face machining B (swivel)	
_M68	After block search to ST block before swivel	
_M100	Drawer:	Position before cut-off
_M101		Open during cut-off
_M102		Close after cut-off
_M103	Cut-off completed	
_M110	Tool change	
_M111	After end of tool change cycle (with tool change)	
_M112	Before tool change on retraction plane	
_M113	Before cutting edge reselection	
_M114	After end of tool change cycle (without tool change)	
_M120	Definition: Coupling of counterspindle / main spindle	
_M121	After COUPOF switch off position control	
_M125	Changeover to main spindle	
_M126	Changeover to counterspindle	
_M131	Start of program (ShopTurn program)	
_M132	End of program header (ShopTurn program)	
_M135	End of program loop (ShopTurn program)	
_M136	End of program (ShopTurn program)	
_M140	Block search	Before tool change
_M141		After tool change
_M142		After tool change (new tool from ShopTurn)
_M150	2-channel stock removal:	Leading channel before Balance Cutting
_M151		Leading channel after Balance Cutting
_M152		Following channel before Balance Cutting
_M153		Following channel after Balance Cutting

20.3.4 CUST_MULTICHAN user cycle

Function

The CUST_MULTICHAN cycle is used for multi-channel programming at lathes. It is called at the start of the block when programming with blocks.

In the cycle, e.g. the master spindle is set to the spindle specified at the start of the block. The return value (= 1) can be used to control whether the complete block is skipped.

CUST_MULTICHAN

Parameter	Meaning
_S_NR	Spindle number to which the master spindle is set.
_RET	Return value
= 0	The block is executed corresponding to the run-in mode.
= 1	The entire block is skipped.

20.4 Milling

20.4.1 Technology cycles for milling

Channel-specific cycle setting data

SD55214 $SCS_FUNCTION_MASK_MILL_SET	Milling function screen
Bit 0	Basic setting, milling in climbing.
Bit 2	Depth calculation of the milling cycles, with or without safety clearance.
= 0	Depth calculation of the milling cycles is performed between the reference plane + safety clearance and the depth.
= 1	Depth calculation is performed without including the safety clearance. Bit 2 is effective in the following milling cycles: CYCLE61, CYCLE71, CYCLE76, CYCLE77, CYCLE79, CYCLE899, LONGHOLE, SLOT1, SLOT2, POCKET3, POCKET4.

Contour milling (CYCLE63)

SD55460 $SCS_MILL_CONT_INITIAL_RAD_FIN		Finishing approach circle radius The radius of the approach circle during the finishing of contour pockets is affected.
= –1	The radius is selected so that at the starting point the safety clearance to the finishing allowance is maintained (default value).	
= >0	The radius is selected so that at the starting point the value of this channel-specific setting data to the finishing allowance is maintained.	

SD55461 $SCS_MILL_CONT_DIFF_TOOLRAD_MIN		Contour pocket milling
= 5	Smallest possible cutter radius deviation (default value).	

SD55462 $SCS_MILL_CONT_DIFF_TOOLRAD_MAX		Contour pocket milling
= 0.01	Largest possible cutter radius deviation (default value).	

Multiple edge (CYCLE79), circular position pattern (HOLES2), circumferential groove (SLOT2)

SD55230 $SCS_CIRCLE_RAPID_FEED	Rapid feed in mm/min for positioning on a circular path between the circumferential grooves or the contour elements.
= 10000	

20.4.2 Cylinder surface transformation (TRACYL)

Software option

You require the following software option in order to use this function:
"Transmit and peripheral surface transformation".

Precondition

- There must be at least one rotary axis at the machine.
- The milling tool must be radially oriented to the cylinder to be machined.

Function

The following groove machining operations can be performed with the Cylinder surface transformation functions:

- Longitudinal grooves on cylindrical bodies
- Transverse grooves on cylindrical objects
- Grooves with any path on cylindrical bodies

The path of the grooves is programmed with reference to the unwrapped, level surface of the cylinder. Programming can be realized using straight line/circle, drilling or milling cycles or contour milling (free contour programming).

There are two variants of cylinder surface transformation, i.e.

1. with groove side offset (ON)
2. without groove side offset (OFF)

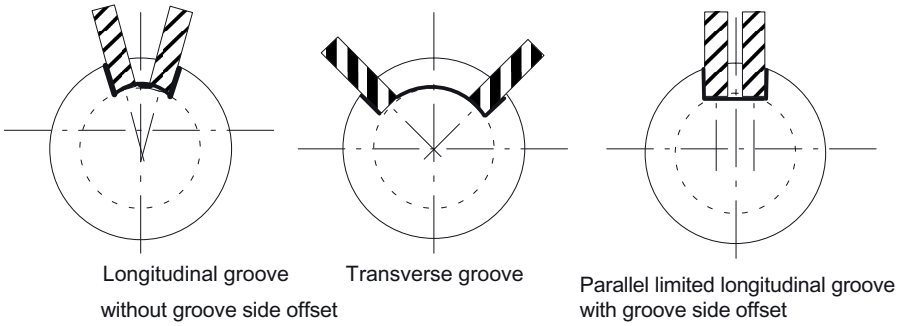
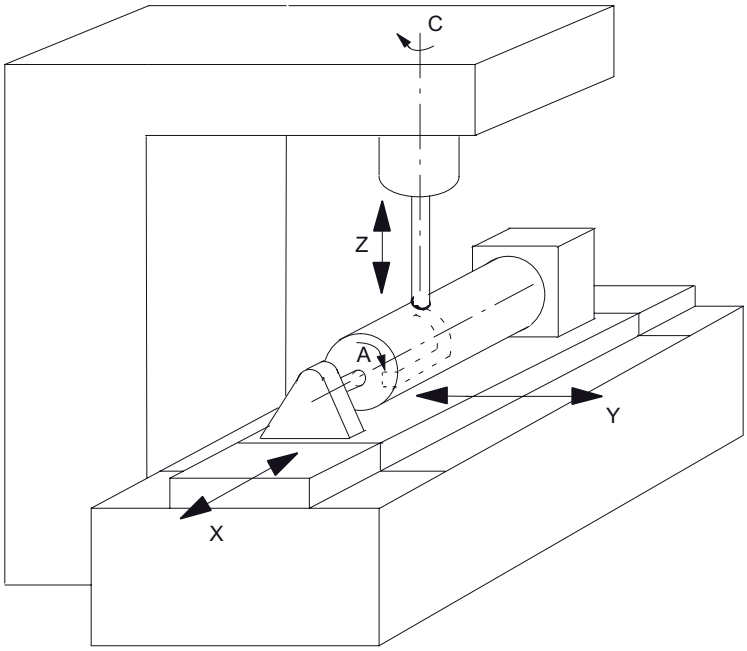


Figure 20-1 Grooves with and without groove side offset

20.4.3 Example: Milling machine with the XYZ-AC axis configuration

Axis configuration

Example of an axis configuration on the following machine:



X 1st axis of the machining plane parallel to the rotary axis
Y 2nd axis of the machining plane
Z Infeed axis (tool axis) perpendicular (radial) to the rotary axis
A Rotary axis
C Working spindle

Figure 20-2 Machining slots on a cylinder surface with X-A-Z kinematics

You must configure two data records with the following machine data for the machine illustrated above:

MD20070 $MC_AXCONF_MACHAX_USED[4]	Machine axis number valid in channel
= 5	Number of channel axes

MD20080 $MC_AXCONF_CHANAX_NAME_TAB[ ]	Name of channel axis in the channel
[0] = XC	Channel axis XC, corresponds to channel axis 1
[1] = YC	Channel axis YC, corresponds to channel axis 2
[2] = ZC	Channel axis ZC, corresponds to channel axis 3

[3] = A	Channel axis A, corresponds to channel axis 4
[4] = C	Channel axis C, corresponds to channel axis 5

MD28082 $MC_MM_SYSTEMFRAME_MASK	System frames (SRAM)
= 21H	Default setting
Bit 0 = 1	System frame for actual value setting and scratching
Bit 5 = 1	System frame for cycles
Bit 6 = 1	System frame for transformations

General settings for the transformation

MD10602 $MN_FRAME_GEOAX_CHANGE_MODE	Frames when switching over geometry screens
= 1	The actual total frame (zero offsets) is recalculated when switching over geometry axes (selecting - deselecting TRACYL).

Data set for the 1st transformation in the channel

MD24100 $MC_TRAFO_TYPE_1	Definition of transformation 1 in the channel.
= 512	Transformer type (512 = cylinder surface transformation without groove side offset)

MD24110 $MC_TRAFO_AXES_IN_1	Axis assignment for the 1st transformation in the channel	
[0] = 3	Channel axis: Infeed axis (tool axis) perpendicular (radial) to the rotary axis	Z
[1] = 4	Channel axis: Rotary axis	A
[2] = 1	Channel axis: 1st axis of the machining plane parallel to the rotary axis	X
[3] = 2	Channel axis: 2nd axis of the machining plane	Y

MD24120 $MC_TRAFO_GEOAX_ASSIGN_TAB_1	Assignment of the geometry axes to channel axes for transformation 1.	
[0] = 1	Channel axis: 1st geometry axis	X
[1] = 4	Channel axis: 2nd geometry axis	A
[2] = 3	Channel axis: 3rd geometry axis	Z

MD24800 $MC_TRACYL_ROT_AX_OFFSET_1	
= 0	Offset of rotary axis for the 1st TRACYL transformation.

MD24805 $MC_TRACYL_ROT_AX_FRAME_1	
= 1	Axial offset of rotary axis for the 1st TRACYL transformation.

MD24810 $MC_TRACYL_ROT_SIGN_IS_PLUS_1	
= 1	Sign of the rotary axis for the 1st TRACYL transformation.

MD24820 $MC_TRACYL_BASE_TOOL_1[ ]	
[0] = 0	Vector of basis tool for the 1st TRACYL transformation in XYZ
[1] = 0	
[2] = 0	

Data set for the 2nd transformation in the channel

MD24200 $MC_TRAFO_TYPE_2	
= 513	Transformer type (513 = cylinder surface transformation with groove side offset)

MD24210 $MC_TRAFO_AXES_IN_2		
[0] = 3	Channel axis: Infeed axis perpendicular (radial) to rotary axis	Z
[1] = 4	Channel axis: Rotary axis	A
[2] = 1	Channel axis: 1st axis of the machining plane parallel to the rotary axis	X
[3] = 2	Channel axis: 2nd axis of the machining plane	Y

MD24220 $MC_TRAFO_GEOAX_ASSIGN_TAB_1		
[0] = 1	Channel axis: 1st geometry axis	X
[1] = 4	Channel axis: 2nd geometry axis	A
[2] = 3	Channel axis: 3rd geometry axis	Z

MD24850 $MC_TRACYL_ROT_AX_OFFSET_2	
= 0	Offset of rotary axis for the 2nd TRACYL transformation

MD24855 $MC_TRACYL_ROT_SIGN_IS_FRAME_2	
= 1	Offset of rotary axis for the 2nd TRACYL transformation

MD24860 $MC_TRACYL_ROT_SIGN_IS_PLUS_2	
= 1	Sign of rotary axis for the 2nd TRACYL transformation

MD24870 $MC_TRACYL_BASE_TOOL[ ]	
[0] = 0	Vector of basis tool for the 2nd TRACYL transformation in XYZ
[1] = 0	
[2] = 0	

Note

Data records for transformations

For both data records, you can use any transformations from all available transformations (MD24100 $MC_TRAFO_TYPE_1, MD24200 $MC_TRAFO_TYPE_2, etc.). The two data records need not be directly next to each other.

However, the 1st data record must always be used for "Cylinder surface transformation **without** groove side offset" (= 512) and the 2nd data record for "Cylinder surface transformation **with** groove side offset" (=513).

20.5 Turning

20.5.1 Setting up cycles for turning

Meaning of the axes

You set the meaning of the axes in machine data MD52206 $MCS_AXIS_USAGE[n].

MD52206 $MCS_AXIS_USAGE[n]	Meaning of the axes in the channel [n] channel axis number
3 =	Main spindle (turning)
4 =	C axis of the main spindle (turning)
5 =	Counterspindle (turning)
6 =	C axis of the counterspindle (turning)
7 =	Linear axis of the counterspindle (turning)

Traversing direction

In order that the user interface and cycles know in which direction the spindles and rotary axes rotate, the following settings must be made.

You set the direction of rotation of an NC rotary axis via MD32100 $MA_AX_MOTION_DIR.

MD32100 $MA_AX_MOTION_DIR	Traversing direction
-1	Direction reversal
0, 1	No direction reversal

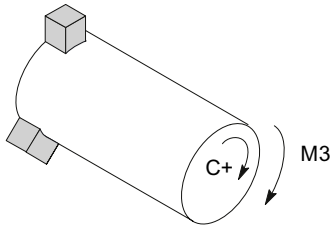
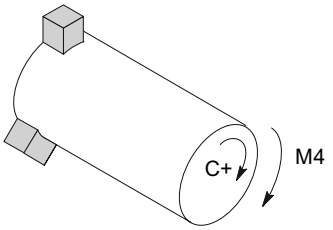
Defining the direction of rotation

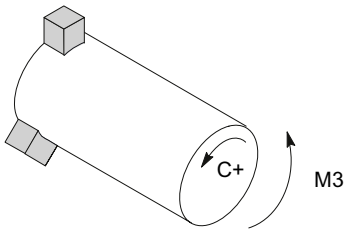
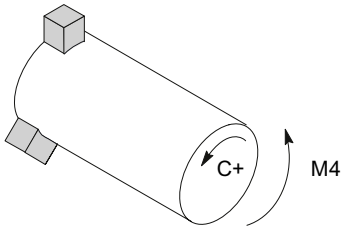
In order to ensure that the rotational direction of the spindle and C axis is correctly displayed on the user interface and when programming, the correct direction of rotation is executed, you must make several settings that are coordinated with one another. You must base these settings on the actual direction of rotation of the spindle/C axis on the machine.

You specify the settings in the following machine data:

MD52207 $MCS_AXIS_USAGE_ATTRIB[n]	Attributes of the axes [n] channel axis number
Bit 3	Displayed positive direction of rotation is counter-clockwise (for rotary axes) The view must be from the inside of the machine (operator's view) to the axis of rotation.
Bit 4	Displayed direction of rotation for M3 is counter-clockwise (for spindles) This bit can be set from the operator's view or according to DIN.
Bit 5	Direction of rotation for M3 corresponds to minus rotary axis (for spindles) This bit must be set analogous to PLC bit DBn.DBX17.6!

As a result, the following setting options are obtained for the main spindle:

Main spindle direction of rotation	**52207[n] bit 3 =**	**52207[n] bit 4 = *)**	**52207[n] bit 5 =**	**DB3n. DBX17.6**
	0	0	0	0
	0	1	1	1

Main spindle direction of rotation	52207[n] bit 3 =	52207[n] bit 4 = *)	52207[n] bit 5 =	DB3n. DBX17.6
	1	1	0	0
	1	0	1	1

Note

MD52207[n] bit 4 = *)

Bit 4 can be set from the operator's view (values as specified) or according to DIN ("0" and "1" are then interchanged).

Additional settings

MD52000 $MCS_DISP_COORDINATE_SYSTEM		Position of the coordinate system
= 0	Default setting	
Examples: 0: Vertical lathe (carousel-type lathe) 19: Horizontal lathe, machining in front of the turning center 34: Horizontal lathe, machining in front of the turning center (inclined bed lathe)		

A detailed description of MD52000 is provided in Section: Activating turning/milling/drilling technologies (Page 385).

The M code, e.g. M34 or M1 = 34 for the spindle chuck is defined in the following machine data. The manufacturer cycle CUST_TECHCYC.SPF takes the M functions from the following machine data:

MD52250 $MCS_M_CODE_CHUCK_OPEN[ ]		M code for open chuck with stationary spindle
[0] = 0	Main spindle	
[1] = 0	Counterspindle	

MD52251 $MCS_M_CODE_CHUCK_CLOSE_OPEN_ROT[ ]	M code for open chuck with spindle rotating
[0] = 0	Main spindle
[1] = 0	Counterspindle

MD52252 $MCS_M_CODE_CHUCK_CLOSE[ ]	M code for close chuck
[0] = 0	Main spindle
[1] = 0	Counterspindle

Enable various functions under the Turning function mask in the following channel-specific configuration machine data.

MD52218 $MCS_FUNCTION_MASK_TURN	Turning function screen
Bit 0	Enable zoom under manual for tool measurement
Bit 1	Enable receptacle for cut-off: NC responds to PLC via auxiliary function(s) by means of the CUST_TECHCYC.SPF and the markers _M100, _M101, _M102 (see above)
Bit 4	Enable spindle control of main spindle via user interface

Rounding the contour

SD55582 $SCS_TURN_CONT_TRACE_ANGLE	Contour turning: Minimum angle for rounding on the contour
= 5	Specifies the angle between the cutting edge and contour, above which for contour turning, the contour is rounded in order to remove residual material (default value).

SD55505 $SCS_TURN_ROUGH_O_RELEASE_DIST	Retraction distance for stock removal during external machining
= 1	Specifies the distance, by which the tool is retracted from the contour when removing stock from an outer corner. This does not apply to stock removal at a contour (default value).
= -1	The distance is internally defined.

SD55506 $SCS_TURN_ROUGH_I_RELEASE_DIST	Retraction distance for stock removal during internal machining
= 0.5	Specifies the distance, by which the tool is retracted from the contour when removing stock from an internal corner. This does not apply to stock removal at a contour (default value).
= -1	The distance is internally defined.

20.5.2 Setting up a counterspindle

Software option

You require the following software options in order to use the counterspindle on your machine:

- "Travel to fixed stop with Force Control"
- "Synchronous spindle/multi-edge turning"

Function

If your turning machine has a counterspindle, you can machine workpieces using turning, drilling and milling functions on the front and rear faces without reclamping the workpiece manually.

Before machining the rear face, the counterspindle must grip the workpiece, pull it out of the main spindle, and position it at the new machining position.

Meaning of the axes

MD52206 $MCS_AXIS_USAGE[n]	Meaning of the axes in the channel [n] channel axis number
= 5	Counterspindle (turning).
= 6	C axis of the counterspindle (turning).
= 7	Linear axis of the counterspindle (turning).

Traversing direction

In order that the user interface and cycles know in which direction the spindles and rotary axes rotate, the following settings must be made.

You set the direction of rotation of an NC rotary axis via MD32100 $MA_AX_MOTION_DIR.

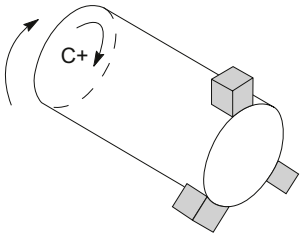
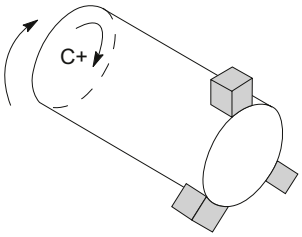
MD32100 $MA_AX_MOTION_DIR	Traversing direction
-1	Direction reversal
0, 1	No direction reversal

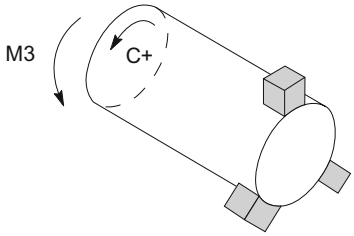
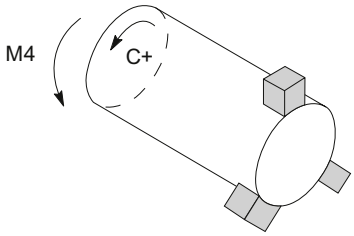
Defining the direction of rotation

You set the directions of rotation for the user interface in the following machine data:

MD52207 $MCS_AXIS_USAGE_ATTRIB[n]	Attributes of the axes in the channel [n] channel axis number
Bit 3	Displayed positive direction of rotation is counter-clockwise (for rotary axes) The view must be from the inside of the machine (operator's view) to the axis of rotation.
Bit 4	Displayed direction of rotation for M3 is counter-clockwise (for spindles) This bit can be set from the operator's view or according to DIN.
Bit 5	Direction of rotation for M3 corresponds to minus rotary axis (for spindles) This bit must be set analogous to PLC bit DBn.DBX17.6!

As a result, the following setting options are obtained for the counterspindle:

Counterspindle direction of rotation	**52207[n] bit 3 =**	**52207[n] bit 4 = *)**	**52207[n] bit 5 =**	**DB3n. DBX17.6**
M3 	1	1	0	0
M4 	1	0	1	1

Counterspindle direction of rotation	52207[n] bit 3 =	52207[n] bit 4 = *)	52207[n] bit 5 =	DB3n. DBX17.6
	0	0	0	0
	0	1	1	1

Note

MD52207[n] bit 4 = *)

Bit 4 can be set from the operator's view (values as specified) or according to DIN ("0" and "1" are then interchanged).

The display must be the same for the main spindle and the counterspindle ("from operator's view" or "according to DIN").

Dimensions

To define the reference point for moving the counterspindle, you must first announce the dimensions of the counterspindle. You can either enter the dimensions in the following axis-specific cycle machine data or in the menu "Tools - zero offset" → ">" → "Spindles". Changes to the machine data are automatically accepted in the menu and vice versa.

MD53240 $MAS_SPINDLE_PARAMETER[ ]	Spindle chuck data
[0]	Chuck dimensions
[1]	Stop dimensions
[2]	Jaw dimensions

MD52241 $MCS_SPINDLE_CHUCK_TYPE	Spindle jaw type
= 0	Clamping, outer
= 1	Clamping, inner

20.5.3 Technology cycles for turning

Thread-cutting (CYCLE99)

During program runtime, the master spindle can be the main spindle or the counterspindle. Bit 3 must be set accordingly in the array index [channel axis number]:

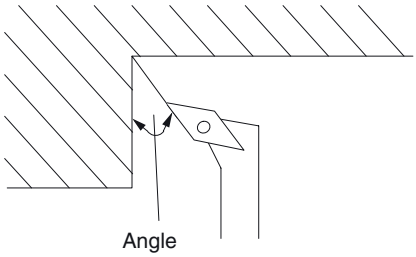
MD52207 $MCS_AXIS_USAGE[n]	Direction of rotation of the master spindle [n] channel axis number
Bit 3	Direction of rotation of the C axis (master spindle) normal or in the opposite direction
= 0	Normal (M3 is +C)
= 1	Opposite (M3 is -C)

Contour groovingCYCLE930, contour turning CYCLE950, stock removal at corner CYCLE951, contour turning CYCLE952

SD55500 $SCS_TURN_FIN_FEED_PERCENT	Enter the finishing feedrate for complete machining, roughing and finishing. The percentage of the value corresponds to that entered under parameter F (feedrate).
= 100	100% finishing feedrate

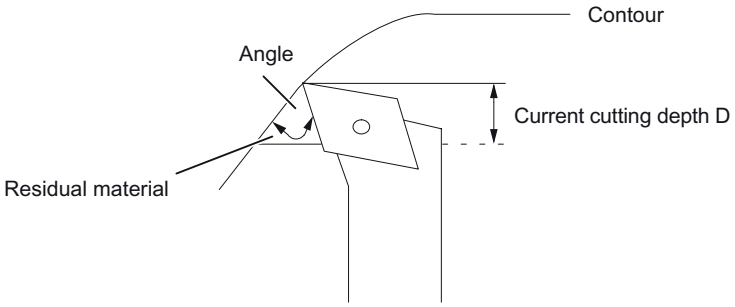
SD55510 $SCS_TURN_GROOVE_DWELL_TIME	Dwell time, which is necessary between grooving and retracting for grooving technology. Tool clearance time during grooving at the base.
= > 0	Dwell time in seconds
= < 0	Dwell time in spindle revolutions

SD55580 $SCS_TURN_CONT_RELEASE_ANGLE	Angle, through which the tool is lifted from the contour for contour turning, roughing.
= 45	Retraction angle of 45 degrees



SD55581 $SCS_TURN_CONT_RELEASE_DIST		Amount, by which the tool is lifted when roughing a contour taking into account the retraction angle SD55580 $SCS_TURN_CONT_RELEASE_ANGLE. This also applies to stock removal, grooving and plunge turning.
= 1	1 mm or 1 inch retraction distance	

SD55582 $SCS_TURN_CONT_TRACE_ANGLE		The angle between cutting edge and contour as of which rounding is performed on the contour during contour turning in order to remove residual material. If the angle of the residual material is greater than that specified in the setting data, the tool will round the contour.
= 5	5 degree angle	



SD55583 $SCS_TURN_CONT_VARIABLE_DEPTH		Percentage of the changing cutting depth when turning a contour You can select changing the cutting depth for stock removal and for removing residual material.
= 20	20% variable cutting depth	

SD55584 $SCS_TURN_CONT_BLANK_OFFSET		Safety clearance when avoiding obstacles, to avoid collisions during approach or retraction from the machining. This also applies to stock removal, grooving and plunge turning.
= 1	1 mm or 1 inch blank allowance	

SD55585 $SCS_TURN_CONT_INTERRUPT_TIME		Time for the feedrate interruption for contour turning. This also applies to stock removal, grooving and plunge turning.
= > 0	Interruption time in seconds	
= < 0	Interruption time in revolutions	
= 0	No interruption	

Note

The channel-specific cycle setting data SD55585 is only evaluated if SD55586 $SCS_TURN_CONT_INTER_RETRACTION = 0.

SD55586 $SCS_TURN_CONT_INTER_RETRACTION		Retraction distance for contour turning for feedrate interruption. This also applies to stock removal, grooving and plunge turning.
= > 0	Retraction distance at feed interruption SD55585 $SCS_TURN_CONT_INTERRUPT_TIME has no effect.	
= 0	No retraction distance	

SD55587 $SCS_TURN_CONT_MIN_REST_MAT_AX1		Limit value during contour turning for removal of residual material in the direction of axis 1 (for G18 Z). This also applies to residual machining – stock removal, grooving and plunge turning.
50	The roughing step for residual machining is not executed, if the material to be removed is less than 50% of the finishing allowance. The material is only removed when finishing.	

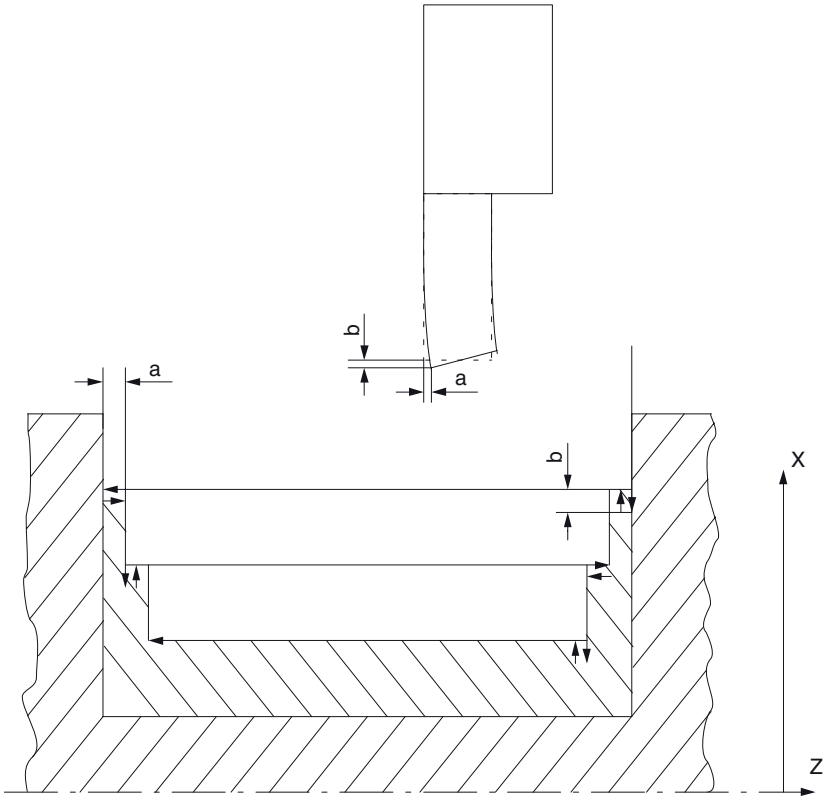
Example: If the SD is set to 50% and the final machining allowance is 0.5 mm, any residual material less than 0.25 mm is not removed with the residual machining – but is removed during finishing. If during a machining step, less residual material is present than defined in the SD, the error message "No material present" is issued. This means that this residual material roughing step can be omitted because no machining is performed.

SD55588 $SCS_TURN_CONT_MIN_REST_MAT_AX2	Limit value during contour turning for removal of residual material in the direction of axis 2 (for G18 X). This also applies to residual machining – stock removal, grooving and plunge turning.
50	The roughing step for residual machining is not executed, if the material to be removed is less than 50% of the finishing allowance. The material is only removed when finishing.

Example: If the SD is set to 50% and the final machining allowance is 0.5 mm, any residual material less than 0.25 mm is not removed with the residual machining, but is removed during finishing. If during a machining step, less residual material is present than defined in the SD, the error message "No material present" is issued. This means that this residual material roughing step can be omitted because no machining is performed.

As the tool bends during plunge turning, the tool cannot travel right up to the contour during stock removal. The lateral distance to the last cut by which the next cut is shortened is specified in the following channel-specific cycle setting data.

SD55595 $SCS_TURN_CONT_TOOL_BEND_RETR	Retraction distance because of tool bending
0.1	0.1 mm or 0.1 inch retraction distance



a Distance to the last cut, SD55595

b Retraction between plunge-cutting and stock removal, SD55596

As the tool bends during plunge turning, the tool would make an excessively deep cut during stock removal. The retraction distance of the tool between plunge-cutting and stock removal is specified in the following channel-specific cycle setting data:

SD55596 $SCS_TURN_CONT_TURN_RETRACTION		Retraction depth before turning
= 0.1	0.1 mm or 0.1 inch retraction depth	

20.5.4 Axis configuration of a lathe

General configuration

If driven milling tools are available on a lathe, then the following functions can also be set-up on this machine:

- Cylinder surface transformation (TRACYL) (Page 414)
- End face machining (TRANSMIT) (Page 417)

Lathe with X and Z axes, main and tool spindle

For example, for a lathe with X and Z axes, main spindle (C1) and tool spindle (WZ), you can configure the following channel-specific machine data:

MD20080 $MC_AXCONF_CHANAX_NAME_TAB[ ]	Channel axis name in the channel
[0] = XC	Channel axis XC
[1] = ZC	Channel axis ZC
[2] = C1	Main spindle C1
[3] = WZ	Tool spindle WZ

Lathe with X and Z axes, main and tool spindle and counterspindle

For example, for a lathe with X and Z axes, main spindle (C1), tool spindle (WZ) and counterspindle (C2), you can configure the following machine data:

MD20080 $MC_AXCONF_CHANAX_NAME_TAB[ ]	Channel axis name in the channel
[0] = XC	Channel axis XC
[1] = ZC	Channel axis ZC
[2] = C1	Main spindle C1
[3] = WZ	Tool spindle WZ
[5] = C2	Counterspindle C2

Lathe with X and Z axes, main and tool spindle and Y axis

For example, for a lathe with X, Z and Y axes, main spindle (C1) and tool spindle (WZ), you can configure the following machine data:

MD20080 $MC_AXCONF_CHANAX_NAME_TAB[ ]	Channel axis name in the channel
[0] = XC	Channel axis XC
[1] = ZC	Channel axis ZC
[2] = C1	Main spindle C1
[3] = WZ	Tool spindle WZ
[5] = YC	Channel axis YC

20.5.5 Cylinder surface transformation (TRACYL)

Software option

You require the following software option in order to use this function:

"Transmit and peripheral surface transformation"

Function

Using the cylinder surface transformation function (TRACYL), you can machine the peripheral surface of a turned part.

Setting up

General settings for cylinder transformation

MD10602 $MN_FRAME_GEOAX_CHANGE_MODE	Frames when switching over geometry axes.
= 1	The actual total frame (work offsets) and when switching over geometry axes (selecting - deselecting TRACYL) is recalculated.

MD24040 $MC_FRAME_ADAPT_MODE	Adapting the active frames
Bit 0 = 0	
Bit 1 = 0	
Bit 2 = 0	

MD28082 $MC_MM_SYSTEM_FRAME_MASK	
Bit 6 = 1	Configuration of channel-specific system frames, which are included in the channel calculation.

When setting up the functions, you can take the following channel-specific machine data into account:

MD24300 $MC_TRAFO_TYPE_3		Cylinder surface transformation, main spindle: Transformation 3
= 512	Without groove side offset (without Y axis)	
= 513	With groove side offset (with Y axis):	
= 514	With groove side offset and Y offset	

MD24400 $MC_TRAFO_TYPE_4		Cylinder surface transformation, counterspindle: Transformation 4
= 512	Without groove side offset (without Y axis)	
= 513	With groove side offset (with Y axis)	
= 514	With groove side offset and Y offset	

Note

You must also set up other machine data for each of the individual transformations.

Cylinder surface transformation without groove side offset

MD24300 $MC_TRAFO_TYPE_3		Definition of the 3rd transformation in the channel
= 512	TRACYL main spindle.	

MD24310 $MC_TRAFO_AXES_IN_3[ ]		Axis assignment for transformation 3
[0] = 1	Perpendicular to the rotary axis XC	
[1] = 3	Rotary axis (main spindle) C1	
[2] = 2	Parallel to the rotary axis ZC	

MD24320 $MC_TRAFO_GEOAX_ASSIGN_TAB_3[ ]		Assignment of geometry axes to channel axes for transformation 3.
[0] = 1	1. channel axis X	
[1] = 3	2. channel axis Y	
[2] = 2	3. channel axis Z	

MD24800 $MC_TRACYL_ROT_AX_OFFSET_1	Offset of the rotary axis for the 1st TRACYL transformation.
= 0	

MD24805 $MC_TRACYL_ROT_AX_FRAME_1	Axial offset of the rotary axis is taken into account during TRACYL.
= 2	

MD24810 $MC_TRACYL_ROT_SIGN_IS_PLUS_1	Sign of the rotary axis for the 1st TRACYL transformation.
= 1	

MD24820 $MC_TRACYL_BASE_TOOL_1[ ]	Vector of the basis tool for the 1st TRACYL transformation.
[0] = 0	
[1] = 0	
[2] = 0	

Cylinder surface transformation with groove side offset

MD24300 $MC_TRAFO_TYPE_3	Definition of the 3rd transformation in the channel
= 513	TRACYL main spindle

MD24310 $MC_TRAFO_AXES_IN_3[ ]	Axis assignment for transformation 3
[0] = 1	Perpendicular to the rotary axis XC
[1] = 3	Rotary axis (main spindle) C1
[2] = 2	Parallel to the rotary axis ZC
[3] = 6	Parallel to the cylinder surface and perpendicular to the rotary axis ZC

MD24320 $MC_TRAFO_GEOAX_ASSIGN_TAB_3[ ]	Assignment of geometry axes to channel axes for transformation 3.
[0] = 1	1. channel axis X
[1] = 3	2. channel axis Y
[2] = 2	3. channel axis Z

MD24800 $MC_TRACYL_ROT_AX_OFFSET_1	Offset of the rotary axis for the 1st TRACYL transformation.
= 0	

MD24805 $MC_TRACYL_ROT_AX_FRAME_1	Axial offset of the rotary axis is taken into account during TRACYL.
= 2	

MD24810 $MC_TRACYL_ROT_SIGN_IS_PLUS_1	Sign of the rotary axis for the 1st TRACYL transformation.
= 1	

MD24820 $MC_TRACYL_BASE_TOOL_1[ ]	Vector of the basis tool for the 1st TRACYL transformation.
[0] = 0	
[1] = 0	
[2] = 0	

20.5.6 End face machining (TRANSMIT)

Software option

You require the following software option in order to use this function:

"Transmit and peripheral surface transformation"

Function

Using the end face machining function (TRANSMIT), you can machine the end face of a turned part.

Setting up

For general settings for transformations, please refer to Chapter "Cylinder surface transformation (TRACYL) (Page 414)".

You can make additional settings in the following channel-specific machine data:

MD24100 $MC_TRAFO_TYPE_1	End face machining, main spindle: Transformation 1
= 256	Machining without Y axis
= 257	Machining with Y axis

MD24200 $MC_TRAFO_TYPE_2	End face machining, counterspindle: Transformation 2
= 256	Machining without Y axis
= 257	Machining with Y axis

MD24110 $MC_TRAFO_AXES_IN_1[ ]	Axis assignment for the 1st transformation in the channel
[0] = 1	Perpendicular to the rotary axis XC
[1] = 3	Rotary axis (main spindle) C1
[2] = 2	Parallel to the rotary axis ZC

MD24120 $MC_TRAFO_GEOAX_ASSIGN_TAB_1[ ]	Assignment of the geometry axes to channel axes for transformation 1
[0] = 1	1. channel axis X
[1] = 3	2. channel axis Y
[2] = 2	3. channel axis Z

MD24900 $MC_TRANSMIT_ROT_AX_OFFSET_1	
= 0	Offset of the rotary axis for the 1st TRANSMIT transformation.

MD24905 $MC_TRANSMIT_ROT_AX_FRAME_1	
= 2	Axial offset of the rotary axis is taken into account during TRANSMIT 1.

MD24910 $MC_TRANSMIT_ROT_SIGN_IS_PLUS_1	
= 0	Sign of the rotary axis for the 1st TRANSMIT transformation.

MD24911 $MC_TRANSMIT_POLE_SIDE_FIX_1	
= 1	Limitation of working range in front of / behind the pole, 1st TRANSMIT.

MD24920 $MC_TRANSMIT_BASE_TOOL_1[ ]	Vector of the basis tool for the 1st TRANSMIT transformation.
[0] = 0	
[1] = 0	
[2] = 0	

TRANSMIT with real Y axis

MD24100 $MC_TRAFO_TYPE_1	
= 257	Definition of transformation 1 in the channel: TRANSMIT main spindle.

MD24110 $MC_TRAFO_AXES_IN_1[ ]	Axis assignment for the 1st transformation in the channel.
[0] = 1	Perpendicular to the rotary axis XC
[1] = 3	Rotary axis C1
[2] = 2	Parallel to the rotary axis ZC

MD24120 $MC_TRAFO_GEOAX_ASSIGN_TAB_1[ ]	Assignment of the geometry axes to channel axes for transformation 1.
[0] = 1	1. channel axis X
[1] = 3	2. channel axis Y
[2] = 2	3. channel axis Z

MD24900 $MC_TRANSMIT_ROT_AX_OFFSET_1	
= 0	Offset of the rotary axis for the 1st TRANSMIT transformation.

MD24905 $MC_TRANSMIT_ROT_AX_FRAME_1	
= 2	Axial offset of the rotary axis is taken into account during TRANSMIT 1.

MD24910 $MC_TRANSMIT_ROT_SIGN_IS_PLUS_1	
= 0	Sign of the rotary axis for the 1st TRANSMIT transformation.

MD24911 $MC_TRANSMIT_POLE_SIDE_FIX_1	
= 1	Limitation of working range in front of / behind the pole, 1st TRANSMIT.

MD24920 $MC_TRANSMIT_BASE_TOOL_1[ ]	Vector of the basis tool for the 1st TRANSMIT transformation.
[0] = 0	
[1] = 0	
[2] = 0	

References

Additional information on face end machining is provided in:

Function Manual, Extended Functions; Kinematic Transformation (M1): TRANSMIT

20.5.7 Inclined Y axis (TRAANG)

Software option

You require the following software option in order to use the inclined Y axis function on your machine:

"Inclined axis"

Function

If your lathe has an inclined Y axis (i.e. this axis is not perpendicular to axes X and Z), you can still completely program machining operations in Cartesian coordinates. The control uses the inclined axis function (TRAANG) to transform the Cartesian coordinates to the motion of the inclined axis.

Setting up

You still have to set up the inclined axis function (TRAANG) via machine data.

References

Function Manual, Extended Functions; Kinematic Transformations (M1): TRAANG

Example

For example, for a turning machine with X and Z axes and inclined Y axis, main spindle (C) and tool spindle (WZ), you must configure the following machine data:

MD20050 $MC_AXCONF_GEOAX_ASSIGN_TAB[ ]	Assignment of geometry axis to channel axis.
[0] = 1	1. real geometry axis X axis.
[1] = 0	2. real geometry axis, Y axis not available.
[2] = 2	3. real geometry axis, Z axis.

MD20110 $MC_RESET_MODE_MASK	
Bit 0 = 1 Bit 7 = 0	TRAANG is retained after ramp-up.

MD20112 $MC_START_MODE_MASK	
Bit 7 = 1	TRAANG is retained after "Cycle start".

MD20118 $MC_GEOAX_CHANGE_RESET	
= 1	Allow automatic geometry axis change.

MD20140 $MC_TRAFO_RESET_VALUE	
= 5	TRAANG always active after reset.

MD20144 $MC_TRAFO_MODE_MASK	
Bit 0 = 1	TRAANG runs in the background (persistent) and is not shown on the user interface.

MD20070 $MC_AXCONF_MACHAX_USED[4]	
= 5	Channel axis YC = 5th machine axis.

MD20080 $MC_AXCONF_CHANAX_NAME_TAB[ ]	Name of channel axis in the channel.
[0] = XC	1. channel axis XC
[1] = ZC	2. channel axis ZC
[2] = C	3. channel axis C
[3] = WZ	4. channel axis WZ
[4] = YC	5. channel axis YC

Data set for inclined axis:

MD24430 $MC_TRAFO_TYPE_5	
= 1024	Transformation 5: TRAANG

MD24432 $MC_TRAFO_AXES_IN_5[ ]	Axis assignment for transformation 5.
[0] = 5	1. transformation axis = channel axis, YC
[1] = 1	2. transformation axis = channel axis, XC
[2] = 2	3. transformation axis = channel axis, ZC

MD24434 $MC_TRAFO_GEOAX_ASSIGN_TAB_5[ ]	Assignment of geometry axes to channel axes for transformation 5.
[0] = 1	1. axis = channel axis, XC
[1] = 5	2. axis = channel axis, YC
[2] = 2	3. axis = channel axis, ZC

MD24436 $MC_TRAFO_INCLUDES_TOOL_5	
= 0	Tool handling with active transformation 5.

MD24700 $MC_TRAANG_ANGLE_1	
= 55	Angle between 1st and 2nd transformer axis. Data record for linking (TRACON) of end face machining on main spindle (TRANSMIT) and inclined axis (TRAANG).

Data record for linking (TRACON) of end face machining on main spindle (TRANSMIT) and inclined axis (TRAANG):

MD24440 $MC_TRAFO_TYPE_6	
= 8192	Type of transformation that is available as sixth in the channel.

MD24444 $MC_TRAFO_GEOAX_ASSIGN_TAB_6[ ]	Assignment of geometry axes to channel axes for transformation 6.
[0] = 1	1. axis = channel axis, XC
[1] = 3	2. axis = channel axis, YC
[2] = 2	3. axis = channel axis, ZC

MD24995 $MC_TRACON_CHAIN_1[ ]	Transformation linking
[0] = 1	Number of the TRANSMIT transformation (main spindle) for linking.
[1] = 5	Number of the TRAANG transformation for linking. Data set for linking (TRACON) of cylinder surface transformation on main spindle (TRACYL) and inclined axis (TRAANG).

Data record for linking (TRACON) of cylinder surface transformation on main spindle (TRACYL) and inclined axis (TRAANG):

MD24450 $MC_TRAFO_TYPE_7	
= 8192	Type of transformation 7 in the TRACON channel.

MD24454 $MC_TRAFO_GEOAX_ASSIGN_TAB_7[ ]		Assignment of geometry axes to channel axes for transformation 7.
[0] = 1	1. axis = channel axis, XC	
[1] = 3	2. axis = channel axis, YC	
[2] = 2	3. axis = channel axis, ZC	

MD24996 $MC_TRACON_CHAIN_2[ ]		Transformation linking
[0] = 3	Number of the TRACYL transformation (main spindle) for linking.	
[1] = 5	Number of the TRAANG transformation for linking.	

20.6 Swiveling

20.6.1 Technology cycles for swiveling

Precondition

The commissioning of the kinematic chain of the machine is a mandatory requirement for correct swiveling functionality (CYCLE800). The kinematic chain is stored in the tool parameters $TC_CARR1 to $TC_CARR65.

Note

The vectors of the kinematic chain can be determined with the "Measure kinematics" measuring function (CYCLE996).

To activate the swivel function, there must at least one toolholder that can be oriented (swivel data set) in the NCK and the workpiece, tool and rotary table reference system frames must be activated:

MD18088 $MN_MM_NUM_TOOL_CARRIER	Maximum number of definable toolholders
> 0	

MD28082 $MC_MM_SYSTEM_FRAME_MASK	System frames (SRAM)
= 3DH	
Bit 2 = 1	TCARR and PAROT
Bit 3 = 1	TAROT and TOFRAME
Bit 4 = 1	Workpiece reference points
Bit 5 = 1	System frame for cycles

NOTICE

Changing machine data MD18088 and MD28082 causes the buffered memory to be reorganized.

After changing the machine data, a series start-up file must be generated and downloaded, otherwise, it can be assumed that data will be lost.

To change machine data, you require the following authorization: Access level 1 (manufacturer).

References

Current information:

- "siemensd.txt" file in the supplied software (standard cycles) or
- Description of Functions Basic Functions; Tool Offset (W1) Inclined surface machining with 3 + 2 axes
- Programming Manual, measuring cycles: CYCLE996

Activating the swivel function

The swivel function is enabled on the user interface via the following channel-machine data:

MD52212 $MCS_FUNCTION_MASK_TECH	Cross-technology function mask
Bit 0 = 1	Enable swivel

Configuring input screens

You can configure the input screen for swiveling using the following channel-specific cycle setting data. The setting data is effective for all of the declared swivel data sets.

SD55221 $SCS_FUNKTION_MASK_SWIVEL_SET	Function screen, swiveling CYCLE800
Bit 0	Input field "No swiveling"
= 0	Hide
= 1	Display
Bit 1	Text displayed for retract the tool axis
= 0	Display text Z = "Z", display text Z, XY = "Z,XY"
= 1	Display text Z = "Fixed point 1", Display text Z, XY = "Fixed point 2". If you wish to modify the retraction version "Z" or "Z, XY" via the manufacturer cycle CUST_800.SPF, the neutral text "Fixed point 1" and "Fixed point 2" can be displayed.
Bit 2	Deselect the active swivel set
= 0	If deselection is not permitted, the "Swivel data set" (TC) selection field is not displayed in the "Swivel" input screen.
= 1	Deselection permitted see also swivel data set parameter $TC_CARR37 HUNDRED MILLIONS position
Bit 3	Displays the active swivel plane under swivel in JOG. The setting in the swivel function screen acts on all swivel data sets.

Additional settings

For the swivel function, set the following machine data as a minimum to the following - although this deviates from the default value:

MD10602 $MN_FRAME_GEOAX_CHANGE_MODE	
= 1	The actual total frame (zero offsets) is recalculated when switching over geometry axes (selecting/deselecting TRAORI).

MD11450 $MN_SEARCH_RUN_MODE	Settings, block search
Bit 1 = 1	Activate PROG_EVENT.SPF after block search. This means that for a block search, the rotary axes of the active swivel data set are pre-positioned.

Declare swivel data sets

For the swivel function, swivel data sets must created in the NCK and declared in the following machine data.

MD18088 $MN_MM_NUM_TOOL_CARRIER	Maximum number of definable toolholders that can be oriented. Number of swivel data sets
= 0	Do not declare any swivel data sets
= 1	Declare swivel data sets

If several channels are declared in the NCU, the number of swivel data sets is split up, taking MD28085 $MN_MM_LINK_TOA_UNIT into account.

Example:

MD18088 $MN_MM_NUM_TOOL_CARRIER = 4
Number of channels = 2

Assignment of the TO areas: MD28085 $MN_MM_LINK_TOA_UNIT= 2, this results in two swivel data sets per channel.

Using angular tools

Angular tools are created and managed in the NC with tool type 130. The tool lengths are entered in the tool of tool type 130. If an angular tool is also used on a swiveled machining plane (CYCLE800), the basic tool orientation must be enabled with MD18114 $MM_ENABLE_TOOL_ORIENT = 2. This enables a direction vector to be transferred to the tool in the tool parameters $TC_DPV3[n] to $TC_DPV5[n]. The TOROT (G17), TOROTY (G18), and TOROTX (G19) commands must be programmed for the tool change so that the basic tool orientation is updated.

n = internal tool number

MD18114 $MM_ENABLE_TOOL_ORIENT	Assign orientation to cutting edges. Basic tool orientation
= 0	No basic tool orientation active
= 2	Basic tool orientation active Used for angular tools and swiveling

MD20110 $MC_RESET_MODE_MASK	Initial control setting for RESET and end of part program
Bit 14 = 1	Calculation of the basis and system frames, example: 4041H.

MD20112 $MC_START_MODE_MASK	Basic control setting for START and part program.
400H	

MD20126 $MC_TOOL_CARRIER_RESET_VALUE	Active toolholder at RESET
= 0	No active toolholder on RESET
= > 0 (n)	Toolholder with number n active at RESET MD20126 is written to in CYCLE800 CYCLE800() corresponds to deselect toolholder (MD20126 = 0)

MD20150 $MC_GCODE_RESET_VALUES[ ]	Delete position, G group.
[41] = 1	Delete position, G group 42 on TCOABS
[51] = 2	Delete position, G group 52 on PAROT
[52] = 1 [52] = > 1	Delete position, G group 53 on TOROTOF Delete position, G group 53 on TOROT, TOROTY or TOROTX Used for machine kinematics, types "T" and "M" See parameter $TC_CARR34

Note

If, after a RESET from the NC, a frame must be calculated in the tool direction, then MD20150 $MC_GCODE_RESET_VALUES[52] can be set to a value > 1.

Applications:

- Machine kinematics with Hirth gearing
- Angular tool with basic tool orientation

Note on kinematics (swivel head / mixed kinematics) with Hirth tooth system:

Depending on the active plane (G17,G18,G19), the TOROT command (or TOROTX, TOROTY) is programmed in the NCU (G group 53) to calculate the compensating frame for the Hirth gearing system in CYCLE800. If the Hirth gearing causes the programmed rotation to deviate from the possible positions of the rotary axes, a $P_TOOLFRAME compensating frame is created for swivel head and mixed kinematics (see HMI active ZO/details tool reference).

If the compensating frame must be retained after RESET or end of part program, enter the following value in the channel-specific machine data:

MD20150 $MC_GCODE_RESET_VALUES[52]	Reset behavior of G groups
= 2	For G17 (TOROT)
= 3	For G18 (TOROTY)
= 4	For G19 (TOROTX)

MD20196 $MC_TOCARR_ROTAX_MODE	Rotary axis mode for toolholders with orientation capability
Bit 0 = 1	Swivel data set with a rotary axis used for a rotary table with C axis
Bit 1 = 1	Swivel data set with two rotary axes used for standard swiveling

MD20360 $MC_TOOL_PARAMETER_DEF_MASK	Tool parameter setting
Bit 10 = 1	Orientation vector remains at T0 or D0 (no tool) Used for machine kinematics, types "T" and "M" See parameter $TC_CARR34

MD21186 $MC_TOCARR_ROT_OFFSET_FROM_FR	Offset of the rotary axes for a tool holder with orientation capability from the zero offset of the rotary axis.
= 0	In CYCLE800, the WCS is recalculated when there is a value in the zero offset (ZO) of the rotary axes. If values are entered in the zero offset of the rotary axes of the active swivel data set, the basic position of the swivel data set and therefore also the basic position of the WCS can change.
= 1	A value in the ZO of the rotary axes acts as offset of the tool holder that has orientation capability. The Work remains unchanged.

MD21186 may not be rewritten in a program with call CYCLE800.

If several swivel data sets are declared per channel, and if machine functions need to be activated on changeover between swivel heads or tables, an M command can be issued in the PLC program on switchover to another swivel data set.

MD22530 $MC_TOCARR_CHANGE_M_CODE	M code for swivel data set change
= 0	No swivel data set change
< 0	M code + number of the swivel data set for the swivel data set change

Example

Number of swivel data sets in channel 1	= 2
MD22530 $MC_TOCARR_CHANGE_M_CODE	= -800
Programming swivel data set 1 (TCARR=1)	= M801
Programming swivel data set 2 (TCARR=2)	= M802

With the output of the M commands, the PLC can limit or invert the spindle speed or clamp or release the rotary axes, for example.

Setting the workpiece, tool and rotary table reference

Using the following machine data, you can set the workpiece, tool and rotary table reference system frames or you can influence the behavior of the system frames.

Application: System frames can be active after Reset or Power On, in order to retract a drill from a swiveled position without causing a collision, for example.

MD24006 $MC_CHSFRAME_RESET_MASK	Active system frames after RESET
Bit 4	System frame workpiece reference
= 0	Not active
= 1	Remains active

MD24007 $MC_CHSFRAME_RESET_CLEAR_MASK	Clear system frames after RESET
Bit 4	System frame workpiece reference
= 0	Do not delete
= 1	Delete

When used for measuring or swiveling in JOG, the workpiece reference must be active on RESET and not cleared (cascaded measuring).

MD24006 $MC_CHSFRAME_RESET_MASK	Active system frames after RESET
Bit 4 = 1	System frame for workpiece reference remains active after RESET

MD24007 $MC_CHSFRAME_RESET_CLEAR_MASK	Clear system frames after RESET
Bit 4 = 0	Do not clear system frame workpiece reference after RESET

MD24008 $MC_CHSFRAME_POWERON_MASK	Reset system frames after power on.
Bit 2	System frame rotary table reference (PAROT)
= 0	Do not reset
= 1	Reset
Bit 3	System frame tool reference (TOROT,..)
= 0	Do not reset
= 1	Reset
Bit 4	System frame workpiece reference
= 0	Do not reset
= 1	Reset

MD24080 $MC_USER_FRAME_POWERON_MASK	Settings for settable frames.
Bit 0	
= 0	Settable zero offset via power on not active.
=1	Last active settable zero offset remains active after power on if MD20152 $MC_GCODE_RESET_MODE[7] = 1

Application: Zero offset G5xx, including all rotations, should remain active after Power On.

MD28082 $MC_MM_SYSTEM_FRAME_MASK	Setting-up system frames (SRAM)
Bit 2 = 1	Rotary table reference ($P_PARTFRAME)
Bit 3 = 1	Tool reference ($P_TOOLFRAME)
Bit 4 = 1	Workpiece reference ($P_WPFRAME)

MD28083 $MC_MM_SYSTEM_DATAFRAME_MASK	Setting-up data management, system frames (SRAM)
Bit 2 = 1	Rotary table reference ($P_PARTFRAME)
Bit 3 = 1	Tool reference ($P_TOOLFRAME)
Bit 4 = 1	Workpiece reference ($P_WPFRAME)

MD28085 $MC_MM_LINK_TOA_UNIT	Assigning a TO unit to a channel (SRAM)
If several channels are set-up, then the following can be set in the machine data: The number of toolholders (see MD18088) on the TO unit per channel. - OR Assigning all of the set toolholders to a channel.	

Axial machine data for the modulo rotary axes of the swivel data set

MD30455 $MA_MISC_FUNCTION_MASK	Axis functions
Bit 0	Modulo rotary axis programming
= 0	No modulo rotary axis programming (e.g. 0 to 359.999 degrees)
= 1	Modulo rotary axis programming (e.g. -180 to 180 degrees)
Bit 2	Positioning, rotary axis
= 0	As programmed
= 1	Along the shortest path Application: With the setting bit 2=1, the rotary axis C travels along the shortest path for G90 with DC. Additional information can be taken from the Section "Manufacturer cycle CUST_800.SPF"Manufacturer cycle CUST_800.SPF (Page 453)

MD32010 $MA_JOG_VELO_RAPID[AX] AX = axis name	Rapid traverse in JOG Rotary and machine axes that should travel for swiveling in JOG
= 10000	Rapid traverse in JOG mode for swivel in JOG

SD42980 $SC_TOFRAME_MODE	Setting, frame definition for TOROT, PAROT
= 2000	Swivel (default value)

SD42974 $SC_TOCARR_FINE_CORRECTION	Fine offset TCARR (swivel data set)
= 0	No fine offset of the swivel data set vectors
= 1	Fine offset of the swivel data set vectors The parameters of the swivel data set from $TC_CARR41[n] n…number of the swivel data set and higher apply

Swiveling in the JOG mode

Cycle alarms 62186 and 62187 can be hidden or displayed using the following cycle machine data:

MD55410 $MC_MILL_SWIVEL_ALARM_MASK	Activate fault evaluation CYCLE800
Bit 0	Activates fault 61186
= 0	Hide fault 61186 "Active zero offset G%4 and base (base reference) contains rotations" (default setting).
= 1	Display fault 61186
Bit 1	Activate fault 61187
= 0	Hide fault 61187 "Active base and base reference (G500) contain rotations" (default setting).
= 1	Display fault 61187

20.6.2 CYCLE800 checklist for the identification of the machine kinematics

Note

Identification of the machine kinematics (kinematic chain) according to DIN 66217 or ISO 841-2001

This checklist does not claim to be complete.

- **Do the three linear axes of the machine that are active for the transformation form an orthogonal coordinate system?** Geometry axes XYZ
- **How many swivel kinematics does the machine have?**

  Combinations of two (or one) rotary axis and the three linear axes are always formed.
- **Which kinematics type is it?**

  Swivel head, swivel table or mixed kinematics of swivel head and swivel table.
- **What are the names of the rotary axes of the kinematics?**

  Manual rotary axes are permitted and do not have to be declared in the NC.
- **What is the 1st or 2nd rotary axis of a swivel data set?**

  Rule: Rotary axis 2 is based on rotary axis 1. With mixed kinematics, rotary axis 1 is always the axis for the tool orientation.
- **Is the traversing direction of the linear axes and the rotary axes correct?** Right-hand rule

  Rule: If the linear axis or the rotary axis moves the workpiece, the direction of motion of the axis and also the sign of the rotary axis vector change.
- **What is the initial setting of the kinematics?**

  This defines the tool orientation and the plane G17, G18, G19.
- **Which rotary axis rotates around which axis of the coordinate system or the machine axis (axes)?**

  This defines the rotary axis vectors of the kinematics.

  Example 1:
  Head kinematics. Rotary axis 2 rotates around axis Y → rotary axis vector V2xyz = 0,1,0

  Example 2:
  Table kinematics. Rotary axis 1 rotates around axis X → rotary axis vector V1xyz = -1,0,0

20.6.3 Commissioning of the kinematic chain (swivel data record)

Swivel data set

You must create a swivel data set for every swivel head, swivel table or each combination of both.

Swivel data sets can be declared in several channels (see machine data).

A swivel data set comprises the parameters $TC_CARR1[n] to $TC_CARR65[n]
n = number of the swivel data set.

The parameters of the swivel data set ($TC_CARR1[n] to $TC_CARR65[n]) can be read-in and read-out in the startup operating area. Programming with appropriate value assignment is also possible in an NC program (manufacturer cycle). The parameters of the swivel data set are immediately effective after the program has started.

References

You can find additional information in:

- Function Manual Basic Functions; Tool Offset (W1)
- Function Manual Special Functions; Multiple Transformations (F2)

Offset vectors I1 to I4

The vectors always contain three components, which represent the reference to the X, Y and Z machine axes. The positions in the kinematic chain are measured by the machine manufacturer; they are always relevant with respect to a swivel head / swivel table (swivel data set). Offset vectors I1 to I4 refer to the non-swiveled state of the rotary axes (machine kinematics basic setting).

The machine kinematics used do not need to be fully implemented. However, be aware that the traversing range in the swivel planes may be restricted. If machine kinematics are to be implemented with just one rotary axis, this must always be declared as the 1st rotary axis.

$TC_CARR1[n],	$TC_CARR2[n],	$TC_CARR3[n]	Offset vector I1xyz
$TC_CARR4[n],	$TC_CARR5[n],	$TC_CARR6[n]	Offset vector I2xyz
$TC_CARR15[n],	$TC_CARR16[n],	$TC_CARR17[n]	Offset vector I3xyz
$TC_CARR18[n],	$TC_CARR19[n],	$TC_CARR20[n]	Offset vector I4xyz

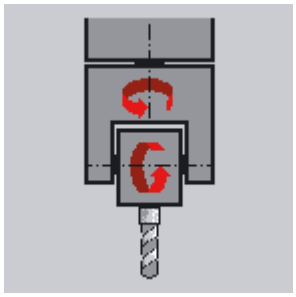
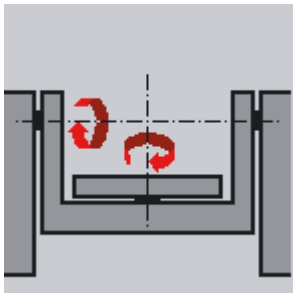
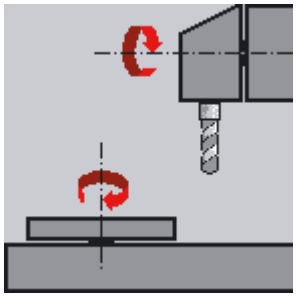
Rotary axis vectors V1 and V2

$TC_CARR7[n],	$TC_CARR8[n],	$TC_CARR9[n]	Rotary axis vector V1xyz
$TC_CARR10[n],	$TC_CARR11[n],	$TC_CARR12[n]	Rotary axis vector V2xyz

Kinematic types $TC_CARR23[n]

Selection:

- Swivel head (type T)
- Swivel table (type P)
- Swivel head + swivel table (type M)

Swivel head (type T)	Swivel table (type P)	Swivel head + swivel table (type M)
		
Offset vector I1	Offset vector I2	Offset vector I1
Rotary axis vector V1	Rotary axis vector V1	Rotary axis vector V1
Offset vector I2	Offset vector I3	Offset vector I2
Rotary axis vector V2	Rotary axis vector V2	Offset vector I3
Offset vector I3	Offset vector I4	Rotary axis vector V2
		Offset vector I4

Offset vectors I1 to I4 $TC_CARR1[n] ... $TC_CARR20[n]

The vectors always contain three components, which represent the reference to the machine axes (X, Y, Z). The positions in the kinematic chain are measured by the machine manufacturer; they are always relevant with respect to a swivel head/swivel table (swivel data record).

Offset vectors I1 to I4 refer to the non-swiveled state of the rotary axes (basic setting: machine kinematics). The machine kinematics used do not need to be fully implemented. However, be aware that the traversing range in the swivel planes may be restricted. If machine kinematics are to be implemented with just one rotary axis, this must always be declared as the 1st rotary axis.

Manually adjustable rotary axes (manual mode) are possible with and without measuring systems and can be used with "plain machines".

Swivel head

- I3 distance from the tool adapter to the pivot point/intersection of the 2nd rotary axis
- I2 distance from the pivot point/intersection of the 2nd rotary axis to the pivot point/intersection of the 1st rotary axis
- I1 closure of the I1=-(I2+I3) vector chain, if the swivel head cannot be changed

Swivel table

- I2 distance from the machine reference point to the pivot point/intersection of the 1st rotary axis
- I3 distance from the pivot point/intersection of the 1st rotary axis to the pivot point/intersection of the 2nd rotary axis (or to the reference point of the tool adapter)
- I4 closure of the I4=-(I2+I3) vector chain, if the swivel table cannot be changed

Swivel head/swivel table (mixed kinematics)

- I2 distance from the tool adapter to the pivot point/intersection of the 1st rotary axis
- I1 closure of the I1=-I2 vector chain, if the swivel head cannot be changed.
- I3 distance from the machine reference point to the pivot point/intersection of the 2nd rotary axis (or to the reference point of the tool adapter)
- I4 closure of the I4=-I3 vector chain, if the swivel table cannot be changed.

The offset vectors do not have to point to the pivot point of the rotary axes. The important thing is that they point to a point on the direction of rotation (intersection).

The sign of the offset vectors (I1 to I4) and the rotary axis vectors (V1, V2) result from the specifications of the axis directions according to **ISO 841-2001** or **DIN 66217** (right-hand rule). In the case of machine kinematics that move the workpiece (rotary table), the axis direction is reversed.

Note

Interrelation of TOOLCARRIER ⇔ 5-axis transformation (transformer type 24, 40, 56):

For 5-axis transformation, transformer type 72 in MD24100: $MC_TRAFO_TYPE_1 can be used.

In the case of transformer type 72, the vectors of the TOOLCARRIER in MD24582: $MC_TRAFO5_TCARR_NO_1 are used.

Swivel head (swivel-mounted tool)			
$TC_CARR23[1]="**T**"			MD24100: $MC_TRAFO_TYPE_1=**24**
I1	$TC_CARR1...3[n]	⇔	MD24500: $MC_TRAFO5_PART_OFFSET_1[0...2]
I2	$TC_CARR4...6[n]		MD24560: $MC_TRAFO5_JOINT_OFFSET_1[0...2]
I3	$TC_CARR15...17[n]		MD24550: $MC_TRAFO5_BASE_TOOL_1 [0...2]
Closure of the **I1=-(I2+I3)** vector chain; for fixed-mounted machine kinematics			

Swivel table (swivel-mounted workpiece)			
$TC_CARR23[1]=**"P"**			MD24100: $MC_TRAFO_TYPE_1=**40**
I2	$TC_CARR4...6[n]	⇔	MD24550: $MC_TRAFO5_BASE_TOOL_1 [0..2]
I3	$TC_CARR15...17[n]		MD24558: $MC_TRAFO5_JOINT_OFFSET_1 [0...2]
I4	$TC_CARR18...20[n]		MD24500: $MC_TRAFO5_PART_OFFSET_1 [0...2]
Closure of the **I4=-(I2+I3)** vector chain; for fixed-mounted machine kinematics			

Swivel head + swivel table (swivel-mounted tool + workpiece)			
$TC_CARR23[1]="**M**"			MD24100: $MC_TRAFO_TYPE_1=**56**
I1	$TC_CARR1...3[n]		MD24560: $MC_TRAFO5_JOINT_OFFSET_1 [0...2]
I2	$TC_CARR4...6[n]		MD24550: $MC_TRAFO5_BASE_TOOL_1 [0...2]
I3	$TC_CARR15...17[n]		MD24558: $MC_TRAFO5_JOINT_OFFSET_PART_1[0...2]
I4	$TC_CARR18...20[n]		MD24500: $MC_TRAFO5_PART_OFFSET_1 [0...2]
Closure of the **I1=-I2 I4=-I3** vector chain; for fixed-mounted machine kinematics			

Rotary axis vectors V1, V2			
V1	$TC_CARR7..9[n]		MD24570: $MC_TRAFO5_AXIS1_1[0..2]
V2	$TC_CARR10..12[n]		MD24670: $MC_TRAFO5_AXIS1_2[0..2]

Name of swivel data record

If several swivel data records are declared in each NC channel, then a name is assigned to each swivel data set. No name needs to be specified if the swivel-mounted tool carrier is not exchangeable (i.e. one swivel data set per channel).

Note

The name of the swivel data set may only contain characters that are permissible for NC programming: A...Z, 0...9 and _ !

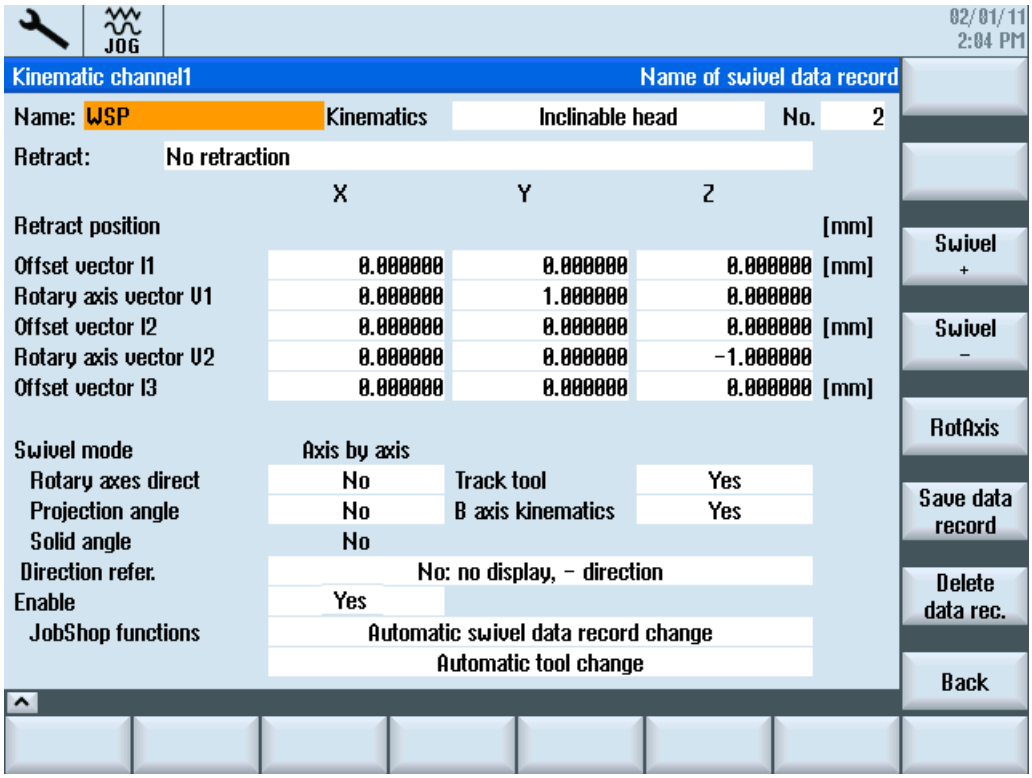


Figure 20-3 Dialog to input parameters for the swivel data set

$TC_CARR34[n]	Name of the swivel data set

Name, rotary axes

The following identifiers should be preferably chosen for the names of the rotary axes:

- Rotary axis rotates around machine axis X → A
- Rotary axis rotates around machine axis Y → B
- Rotary axis rotates around machine axis Z → C

For automatic rotary axes, the channel names of the corresponding NC rotary axes must be entered (see $TC_CARR37[n] TENS and HUNDREDS position: Automatic mode). For manual (manually adjustable) and semi-automatic rotary axes, you can use any axis identifier (up to six letters or numbers).

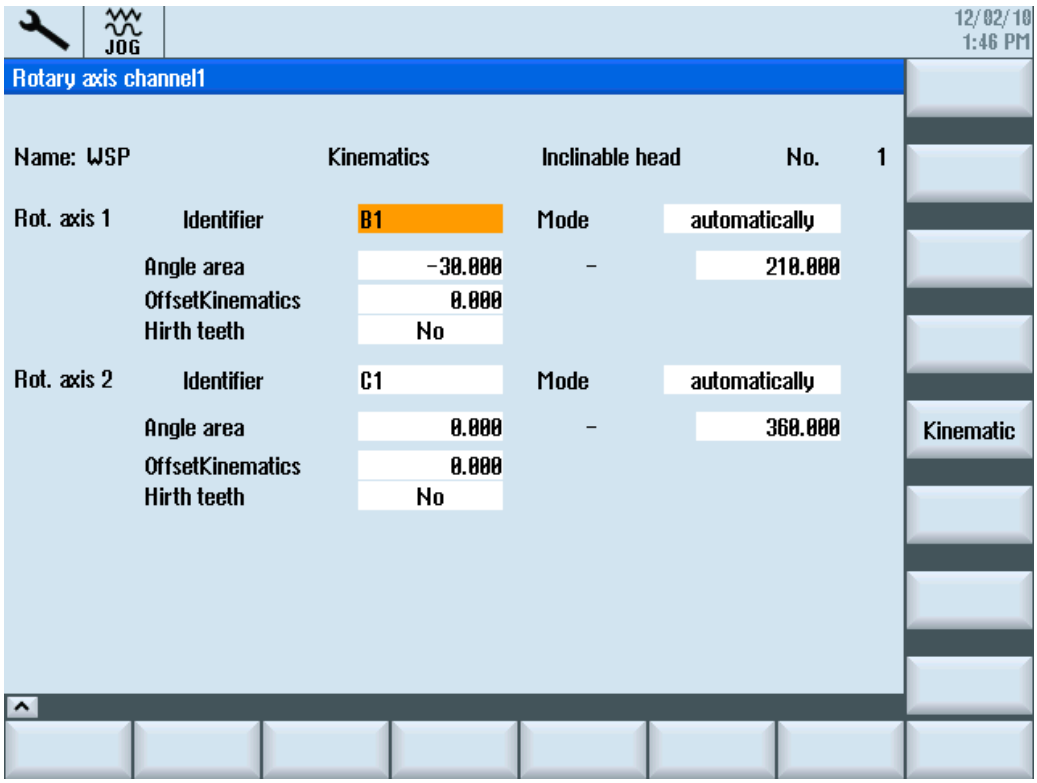


Figure 20-4 Dialog to input parameters for the rotary axis

$TC_CARR35[n]	Name of rotary axis 1
$TC_CARR36[n]	Name of rotary axis 2

System variable $TC_CARR37[n]

In the operating area "Program" → "Miscellaneous", the following softkeys are assigned to the swivel function:

Milling technology	Turning technology	
"Swivel plane"	"Swivel plane"	
"Advance milling tool"	"Swivel tool"	→ "Align turning tool"
		→ "Align milling tool"
		→ "Advance milling tool"

The "Align turning tool" and "Align milling tool"softkeys are only displayed if the "B-axis kinematics" function was activated (refer to the following table).

Significance of the decimal places:

In order that a value can be displayed in the input / selection boxes of the dialog for swiveling, the following display versions can be set.

$TC_CARR37[n]	Display variants of the input screens for CYCLE800	
Decimal place	Meaning	
ONES	Selects the swivel mode	
	0 =	Axis by axis
	1 =	Axis-by-axis + projection angle
	2 =	Axis-by-axis + projection angle + solid angle
	3 =	Axis-by-axis + direct
	4 =	Axis-by-axis + projection angle + direct
	5 =	Axis-by-axis + projection angle + solid angle + direct
TENS	Rotary axis 1	
	0 =	Automatic
	1 =	Manual
	2 =	Semi-automatic
HUNDREDS	Rotary axis 2	
	0 =	Automatic
	1 =	Manual
	2 =	Semi-automatic
THOUSANDS	Selection field, direction: Direction selection of the rotary axes	
	0 =	No display of the direction reference for kinematics that only have one solution. Direction selection (_DIR) Minus is generated in the cycle call CYCLE800.
	3 =	Direction reference, rotary axis 1, direction selection Minus in the basic setting of the kinematics.
	4 =	Direction reference, rotary axis 2, direction selection Minus in the basic setting of the kinematics.
	5 =	No display of the direction reference for kinematics that only have one solution. Direction selection (_DIR) Plus is generated in the cycle call CYCLE800.

$TC_CARR37[n]	**Display variants of the input screens for CYCLE800**		
Decimal place	**Meaning**		
	8 =	Direction reference, rotary axis 1, direction selection Plus in the basic setting of the kinematics.	
	9 =	Direction reference, rotary axis 2, direction selection Plus in the basic setting of the kinematics.	
		The values 1, 2, 6 and 7 are not permitted.	
TEN THOUSANDS	Selection field, correction of the tool tip or B axis kinematics		
	0 =	No display of the correction of the tool tip input field.	
	1 =	Correction of tool tip by means of TRAORI.	
	2 =	No correction of tool tip + B axis kinematics turning technology.	
	3 =	Correction of tool tip + B axis kinematics turning technology. The Correction of tool tip function requires the "5-axis transformation (TRAORI)" option.	
HUNDRED THOUSANDS	Reserved		
ONE MILLION TEN MILLION	Selection field, retraction		
	00 =	No retraction	
	01 =	Retraction Z	
	02 =	Retraction Z, XY	
	03 =	Retraction Z or Z, XY	
	04 =	Maximum retraction in tool direction	
	...		
	08 =	Incremental retraction in tool direction	
	...		
	15 =	Retraction Z or Z, XY or in maximum tool direction or in incremental tool direction	
		$TC_CARR38[n]	Retraction position X
		$TC_CARR39[n]	Retraction position Y
		$TC_CARR40[n]	Retraction position Z
HUNDRED MILLION	Swivel data set enabled Setting swivel data set change Automatic or manual tool change is only required for ShopMill or ShopTurn (→ See also: CUST_800.spf, markers _M2 to _M13). A swivel data set must be "enabled" in each case (value ≥ 4).		
	0 =	Swivel data set not enabled	
	4 =	Swivel data set enabled automatic swivel data set and tool change	
	5 =	Swivel data set enabled automatic swivel data set change and manual tool change	
	6 =	Swivel data set enabled manual swivel data set change and automatic tool change	
	7 =	Swivel data set enabled manual swivel data set and tool change	

Retracting the geometry axes before swiveling

The type of retraction is modified in the manufacturer cycle CUST_800.SPF.

For further information on this, see Chapter Manufacturer cycle CUST_800.SPF (Page 453)

NOTICE
When traversing the tool axes, the following must be taken into account: Retract the tool axis in such a way that the tool and workpiece cannot collide when swiveled.

The ONE MILLION and TEN MILLION positions of the system variable $TC_CARR37[n] define which retraction versions are displayed in the input mask:

- Retraction of axis Z
- Retract axes Z, XY
- Retract in the tool direction, maximum or incremental

Retracting axis Z or retracting axes Z, XY is realized as an absolute machine position at the values of parameters $TC_CARR38[n] to $TC_CARR40[n].

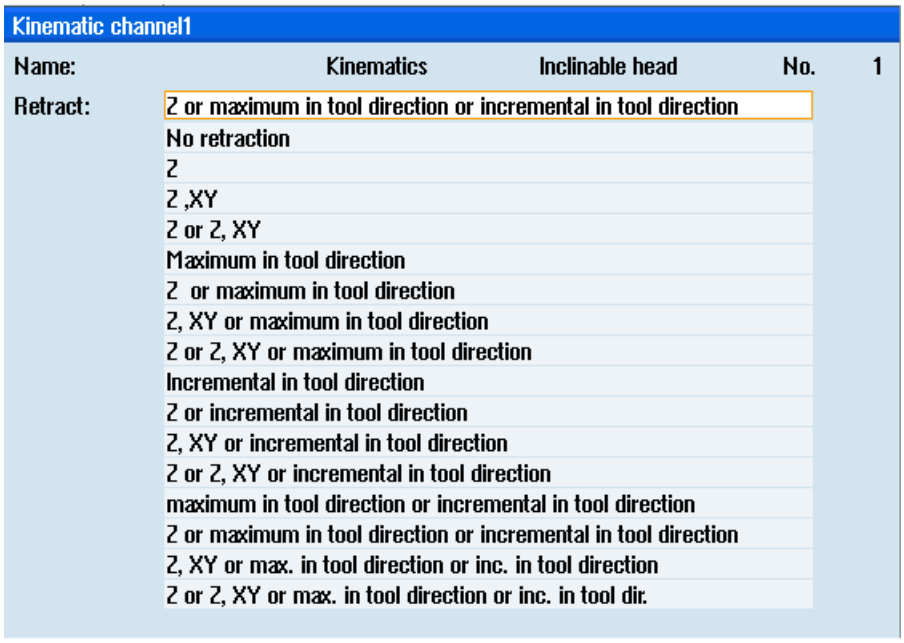


Figure 20-5 Dialog to select the type of retraction

$TC_CARR38[n]	Retraction position X
$TC_CARR39[n]	Retraction position Y
$TC_CARR40[n]	Retraction position Z

Fine offsets of offset vectors

$TC_CARR41[n]	to	$TC_CARR60[n]

Assignment of base vectors to the fine offset vectors:

I1 $TC_CARR1..3[n]	to	$TC_CARR41..43[n]
I2 $TC_CARR4..6[n]	to	$TC_CARR44..46[n]
I3 $TC_CARR15..17[n]	to	$TC_CARR55..57[n]
I4 $TC_CARR18..20[n]	to	$TC_CARR58..60[n]

The fine offsets are activated by the following setting data:

SD42974 $SC_TOCARR_FINE_CORRECTION = 1

The fine offsets act in addition to the corresponding base vectors when the Swivel function CYCLE800 or the NC function TCARR=n is called.

20.6.4 Examples of machine kinematics for the commissioning of the Swivel function

Example 1: Swivel head 1 "HEAD_1"

- Rotary axis 1(C) (manual) around Z
- Rotary axis 2(A) (manual) around X
- Manually adjustable changeable swivel head (manual)

Vectors relate to the kinematics basic setting (drawing not true-to-scale)

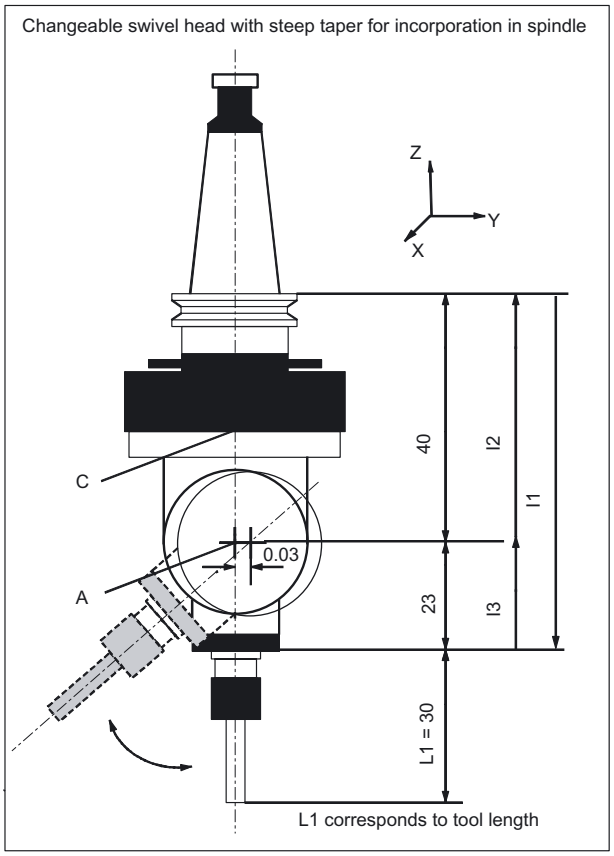


Table 20- 1 Commissioning softkey "Swivel", Kinematics (Example 1)

Kinematics	Swivel head		HEAD_1
Retract	Z		
	X	Y	Z
			200.000
Offset vector I1	0.000	0.030	-63.000
Rotary axis vector V1	0.000	0.000	1.000
Offset vector I2	0.000	0.000	40.000
Rotary axis vector V2	1.000	0.000	0.000
Offset vector I3	0.000	-0.030	23.000
Display version			
Swivel mode	Axis by axis		

Kinematics	**Swivel head**		**HEAD_1**
Direction reference	Rotary axis 2		
Correct tool	No		
Rotary axes			
Rotary axis 1	C	Mode	Manual
Angular range	0.000		360.000
Rotary axis 2	A	Mode	Manual
Angular range	-15.000		100.000

Example 2: Swivel head 2 "HEAD_2"

Rotary axis vector V1: Rotary axis B rotates around Y

Rotary axis vector V2: Rotary axis C rotates around Y **and** around Z

Offset vector I1: Closure of vector chain with fixed-mounted swivel head
I1=-(I2+I3)

Offset vector I2: Distance between pivot point of **rotary axis 1** and pivot point of **rotary axis 2**

Offset vector I3: Distance between reference point of tool and pivot point of **rotary axis 2**

Cardanic swivel head (manually adjustable) with Hirth tooth system

Vectors relate to the basic setting of the kinematics.

If the swivel head is fixed-mounted, the vector chain is closed (see I1)

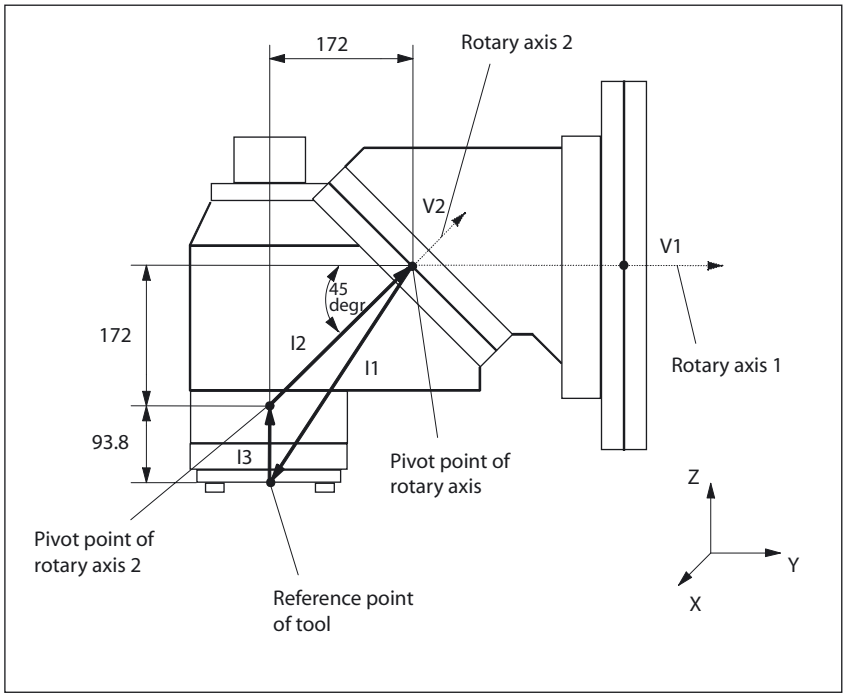


Table 20- 2 Commissioning softkey "Swivel", Kinematics (Example 2)

Kinematics	**Swivel head**		**HEAD_2**
Retract	Z	Tool direction	Max.+inc.
	X	Y	Z
			200.000
Offset vector I1	0.000	-172.000	-265.800
Rotary axis vector V1	0.000	1.000	0.000
Offset vector I2	0.000	172.000	172.000
Rotary axis vector V2	0.000	1.000[1)]	1.000[1)]
Offset vector I3	0.000	0.000	93.800
Display version			
Swivel mode	Axis by axis		
Direction reference	Rotary axis 2		
Rotary axes			
Rotary axis 1	B	Mode	Manual
Angular range	0.000		360.000
Kinematics offset	0.000		
Hirth gearing	Yes	Angular grid	1.000
Rotary axis 2	C	Mode	Manual
Angular range	0.000		180.000
Kinematics offset	0.000		

The reference point of the pivot point of rotary axes 1 and 2 can be offset on the line of rotation and does not have to coincide with the mechanical pivot point.

1) Calculation of rotary axis vector V2: 45 degree angle
V2Y= sin(45)= 0.7071
V2z= cos(45)= 0.7071
V2Y and V2z can be normalized to 1.

Example 3: Cardanic table "TABLE_45"

Vectors relate to the basic setting of the kinematics.

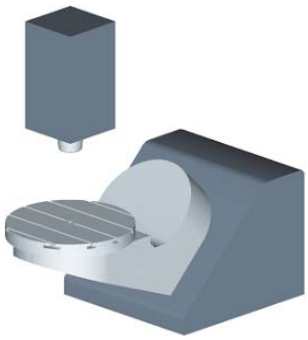
Rotary axis vector V1: Rotary axis B rotates around Y **and** around Z.

Rotary axis vector V2 Rotary axis C rotates around Z.

Offset vector I2: Distance from the reference point of the machine to the pivot point/intersection of **rotary axis 1**

Offset vector I3: Distance between pivot point/intersection of **rotary axis 1** and pivot point/intersection of **rotary axis 2**

Offset vector I4: Closure of vector chain I4=-(I2+I3)



Side view of the machine

Spindle (tool adapter) is positioned on a block dimension above the top edge of the table (rotary axis C) or the center of the table.

A measuring rod in the spindle is used to determine the turning center of rotary axis C.

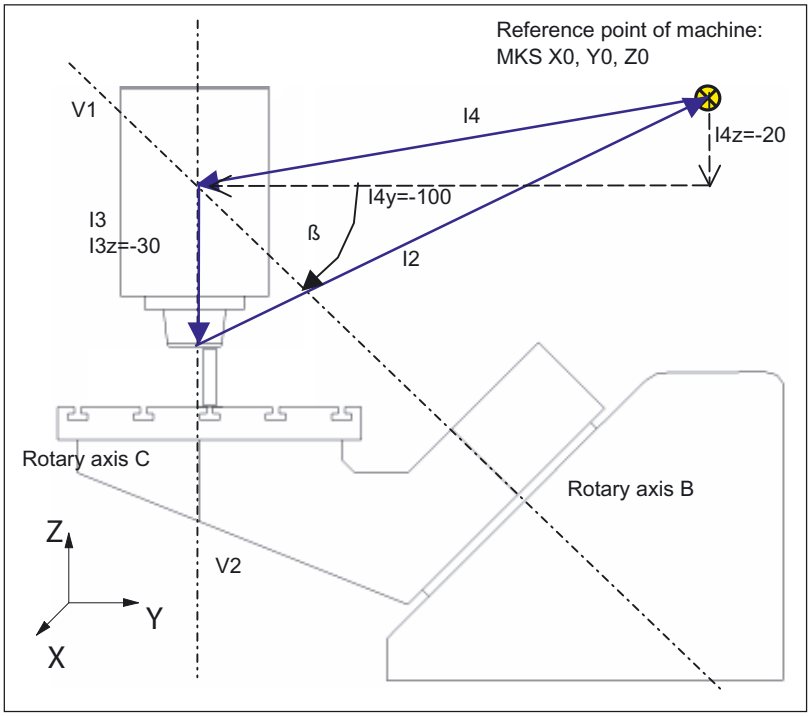


Table 20- 3 Commissioning softkey "Swivel", Kinematics (Example 3)

Kinematics	**Swivel table**		**TABLE_45**
	X	Y	Z
Offset vector I2	0.000	100.000	50.000
Rotary axis vector V1	0.000	-1.000[1)]	1.000[1)]
Offset vector I3	0.000	0.000	-30.000
Rotary axis vector V2	0.000	0.000	-1.000

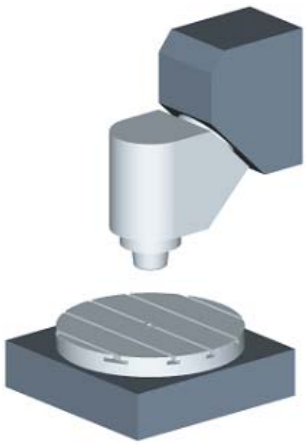
Kinematics	**Swivel table**		**TABLE_45**
Offset vector I4	0.000	-100.000	-20.000
Display version			
Swivel mode	Axis by axis		
Direction reference	Rotary axis 2		
Correct tool	No		
Rotary axes			
Rotary axis 1	B	Mode	Auto
Angular range	0.000		180.000
Rotary axis 2	C	Mode	Auto
Angular range	0.000		360.000

1) Calculation of rotary axis vector V1: β = -45 degrees
V1Y= sin(-45)= -0.7071
V1z= cos(-45)= 0.7071
V1Y and V1z can be normalized to -1 and 1.

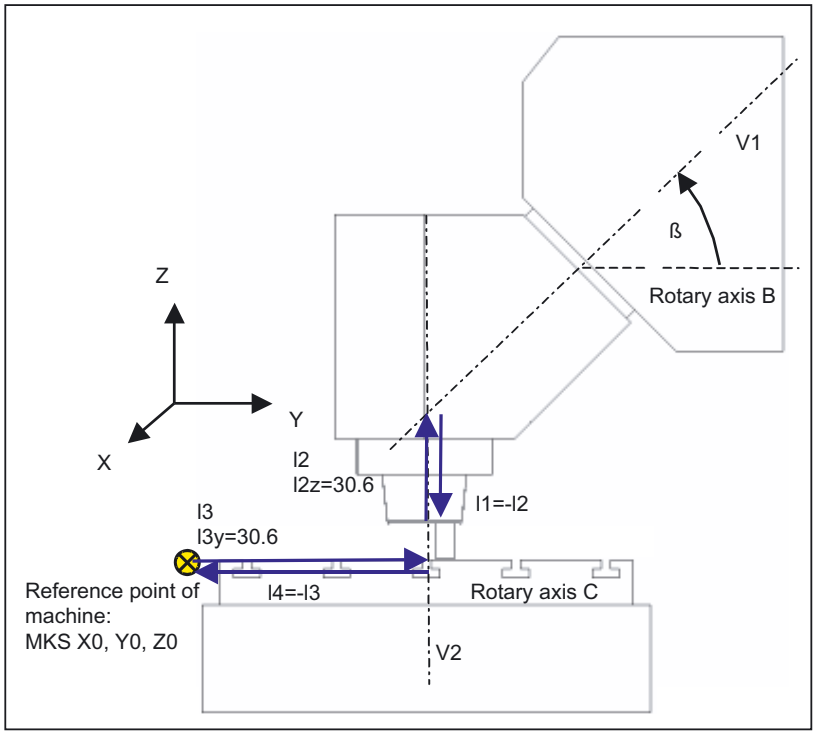
Example 4: Swivel head/rotary table "MIXED_45"

Vectors relate to the basic setting of the kinematics.

Rotary axis vector V1:	Rotary axis B rotates around Y **and** around Z.
Rotary axis vector V2:	Rotary axis C rotates around Z.
Offset vector I2:	Distance from the reference point of the tool adapter to the pivot point/intersection of **rotary axis 1**
Offset vector I1:	Closure of vector chain I1=-I2
Offset vector I3:	Distance from the reference point of the machine to the pivot point/intersection of **rotary axis 2**
Offset vector I4:	Closure of vector chain I4=-I3



Side view of the machine:



Spindle (tool adapter) is positioned on a block dimension above the top edge of the table (rotary axis C) or the center of the table. A measuring rod in the spindle is used to determine the turning center of rotary axis C.

Table 20- 4 Commissioning softkey "Swivel", Kinematics (Example 4)

Kinematics	**Mixed kinematics**		**MIXED_45**
	X	Y	Z
Offset vector I1	0.000	0.000	-30.600
Rotary axis vector V1	0.000	1.000[1)]	1.000[1)]
Offset vector I2	0.000	0.000	30.600
Offset vector I3	300.000	150.000	0.000
Rotary axis vector V2	0.000	0.000	-1.000
Offset vector I4	-300.000	-150.000	0.000
Display version			
Swivel mode	Axis by axis		
Direction	Rotary axis 1		
Correct tool	yes		
Rotary axes			
Rotary axis 1	B	Mode	Auto
Angular range	0.000		180.000

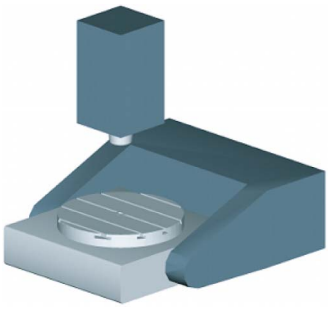
Kinematics	**Mixed kinematics**		**MIXED_45**
Rotary axis 2	C	Mode	Auto
Angular range	0.000		360.000

1) Calculation of rotary axis vector V1: β = 45 degrees
V1Y= sin(45)= -0.7071
V1z= cos(45)= 0.7071
V1Y and V1z can be normalized to 1.

Example 5: Swivel table "TABLE_5"

Vectors relate to the basic setting of the kinematics.

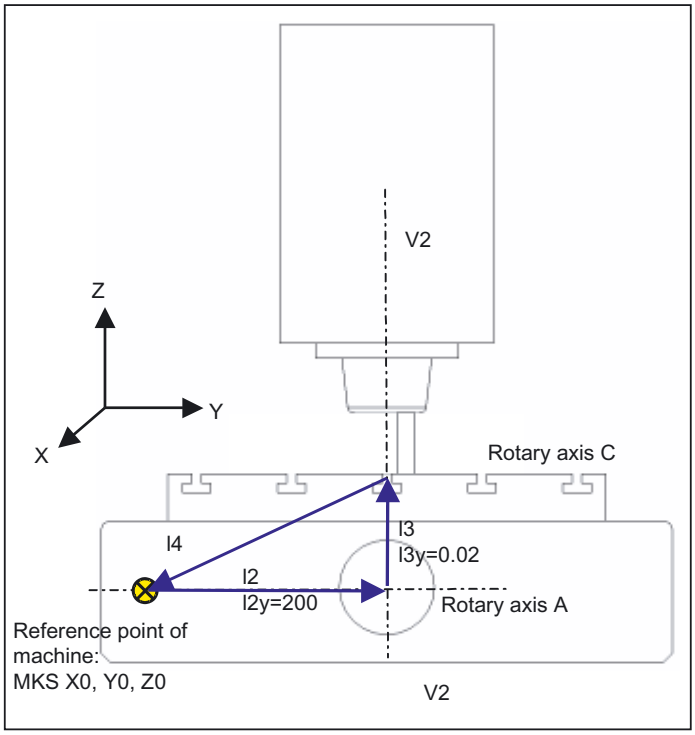
Rotary axis vector V1: Rotary axis A rotates around X.
Rotary axis vector V2: Rotary axis C rotates around Z.
Offset vector I2: Distance from the reference point of the machine to the pivot point/intersection of **rotary axis 1**
Offset vector I3: Distance from the pivot point of rotary axis 1 to the pivot point/intersection of **rotary axis 2**
Offset vector I4: Closure of vector chain I4=-(I2+I3)



Side view of the machine from the X direction

Spindle (tool adapter) is positioned on a block dimension above the top edge of the table (rotary axis C) or the center of the table.

A measuring rod in the spindle is used to determine the turning center of rotary axis C.



Side view of the machine from the Y direction

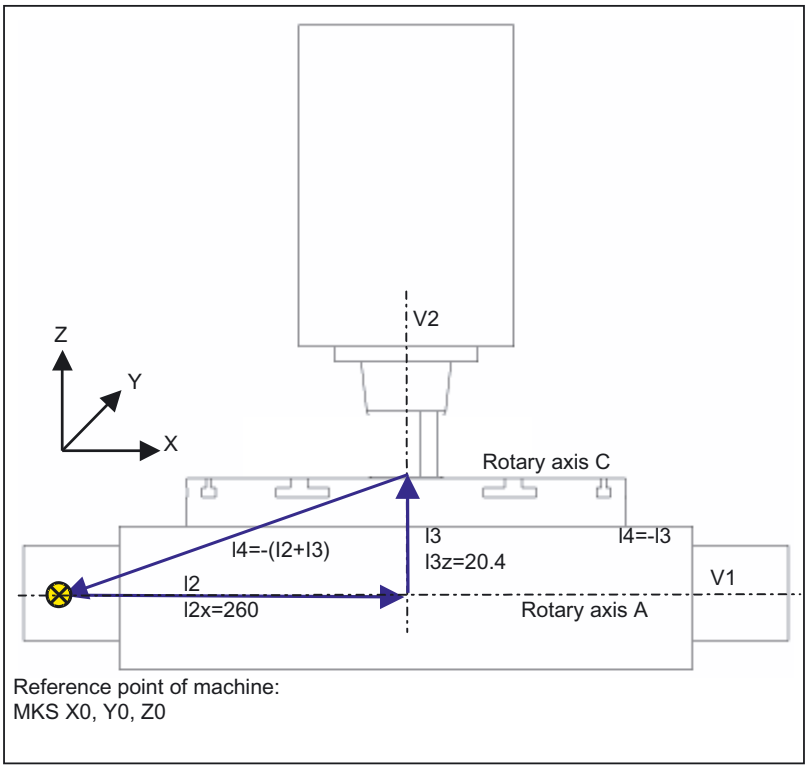


Table 20- 5 Commissioning softkey "Swivel", Kinematics (Example 5)

Kinematics	**Swivel table**		**TABLE_5**
	X	Y	Z
Offset vector I2	260.000	200.000	0.000
Rotary axis vector V1	-1.000	0.000	0.000
Offset vector I3	0.000	0.020	20.400
Rotary axis vector V2	0.000	0.000	-1.000
Offset vector I4	-260.000	-200.020	-20.400
Display version			
Swivel mode	Axis by axis		
Direction	Rotary axis 1		
Correct tool	No		
Rotary axes			
Rotary axis 1	A	Mode	Auto
Angular range	-90.000		90.000
Rotary axis 2	C	Mode	Auto
Angular range	0.000		360.000

Example 6: Setting-up a lathe with B axis

For lathes with an additional rotary axis B, the tool can be aligned or swiveled on the X/Z plane. If your machine has a counterspindle, you can, for example, machine with a tool alternating between the main spindle and counterspindle.

You require the following swivel data sets to use the "Align tool" and "Swivel plane" functions:

- Swivel data set 1 for aligning and swiveling tools on the main spindle and counterspindle (turning, face Y/C, surface Y/C).
- Swivel data set 2 for machining inclined surfaces when milling on the main spindle (face B).
- Swivel data set 3 for machining inclined surfaces when milling on the counterspindle (face B).

When commissioning the "B-axis kinematics turning technology" in parameter $TC_CARR37[n], the TEN THOUSANDS position must be set to 2 or 3 in swivel data set 1. This is the reason why in the program editor "Swivel tool → align turning or milling tool" is listed for swivel data set 1.

See also: Selection box "B-axis kinematics" (Page 433) in the "Dialog to input parameters for the swivel data set"

Example 7: Configuring a milling machine with B axis for turning.

You can configure a milling machine with a B axis (rotation around Y) so that turning is possible.

The following example refers to a milling machine with a rotary axis around Y (B), a rotary axis around Z (C) and a main spindle (SP) in the tool direction Z (G17).

You require the following swivel data sets to use the "Align tool" and "Swivel plane" functions:

- Swivel data set 1 for "Swiveling in the plane" when milling.
  Mixed kinematics: Rotary axis 1: B-axis, rotary axis 2: C axis
- Swivel data set 2 for the "Swivel tool - align tool" when turning
  Swivel head: Rotary axis 1: B-axis, rotary axis 2: Spindle SP

When milling, the SP spindle is the master spindle. Rotary axis C is declared as the master spindle in rotational operation, e.g. SETMS(2).

When commissioning the "B-axis kinematics turning technology" in parameter $TC_CARR37[n], the TEN THOUSANDS position must be set to 2 or 3 in swivel data set 2. This is the reason why in the program editor "Swivel tool → align turning or milling tool" is listed for swivel data set 2.

See also: Selection box "B-axis kinematics" (Page 433) in the "Dialog to input parameters for the swivel data set"

References

Description of Functions, Basic Functions; Tool Offset (W1), Parameter CUTMOD:

- The CUTMOD NC function is activated when data set 2 is called in the NC program (CYCLE800 align turning tool). This means that the cutting edge position or the tool reference point is updated corresponding to the tool orientation:
- When calling a swivel data set for rotational operation in the NC program (CYCLE800 align tool), the CUTMOD NC function is activated. The cutting edge position, tool angle, cut direction and tool reference point are thus calculated in accordance with the current tool orientation following the "Align tool" function.

20.6.5 Manufacturer cycle CUST_800.SPF

Adaptations

During swiveling, all axis positions are approached using the CUST_800.SPF cycle. The call is exclusively made from the swivel cycle CYCLE800 or from the cycles E_TCARR (ShopMill) or F_TCARR (ShopTurn).

In cycle CUST_800.SPF, the function markers (_M2: to _M59) are prepared and documented. Also refer to the following "Structogram CYCLE800".

If you modify the cycle CUST_800.SPF, proceed as follows:

1. Copy cycle CUST_800.SPF from the directory:
   /NC data/Cycles/Standard cycles
2. Insert cycle CUST_800.SPF into the directory:
   /NC data/Cycles/Manufacturer cycles

Note

If you modify the CUST_800, ensure that the G commands of the used G groups are restored at the end of the CUST_800 (S_G_1 to S_G_51 variables).

Parameters of the CUST_800.SPF manufacturer cycle

CUST_800 (INT _MODE, INT _TC1, REAL _A1, REAL _A2, INT _TC2, REAL _T_POS)
SAVE DISPLOF

_MODE	A jump is made to markers _M2 to _M59
_TC1	Number of the swivel head/table
_A1	Angle of rotary axis 1
_A2	Angle of rotary axis 2
_TC2	Feed evaluation in percent (%) for swiveling in JOG mode and number of the new swivel head/table when replaced in ShopMill
_T_POS	Incremental position during retraction in the incremental tool direction (see marker _M44, _M45)

Retract prior to swiveling

If the CUST_800.SPF cycle is not modified, the Z axis (marker _M41) or the Z axis followed by the X, Y axes (marker _M42) are first traversed in the Machine to the positions when retracting prior to swiveling. The freely available position values are specified in the system variables $TC_CARR38[n] to $TC_CARR40[n]. When retracting, the active tool cutting edge is deselected (D0) and is reselected after retraction.

If retraction in the tool direction had been declared, the tool axis is retracted to the software end position (maximum in tool direction) or by an incremental distance away from the tool in the tool direction. The tool lengths are taken into account accordingly.

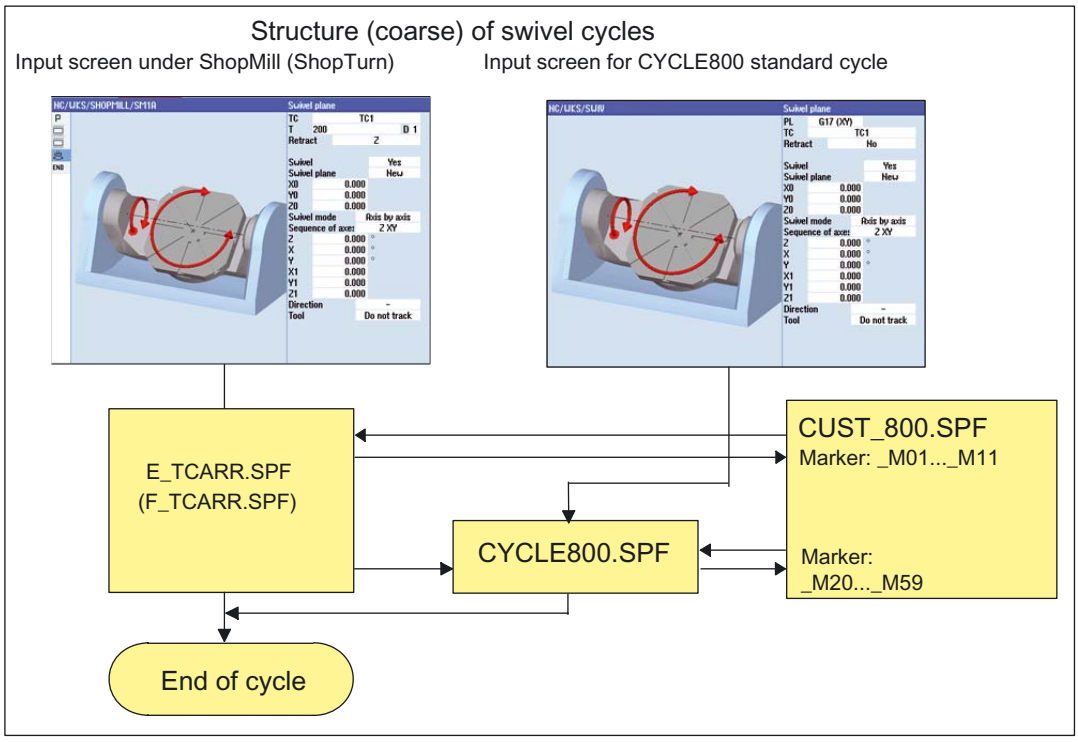


Figure 20-6 Structure (coarse) of swivel cycles

CYCLE800 structured chart

Sequence in AUTOMATIC mode

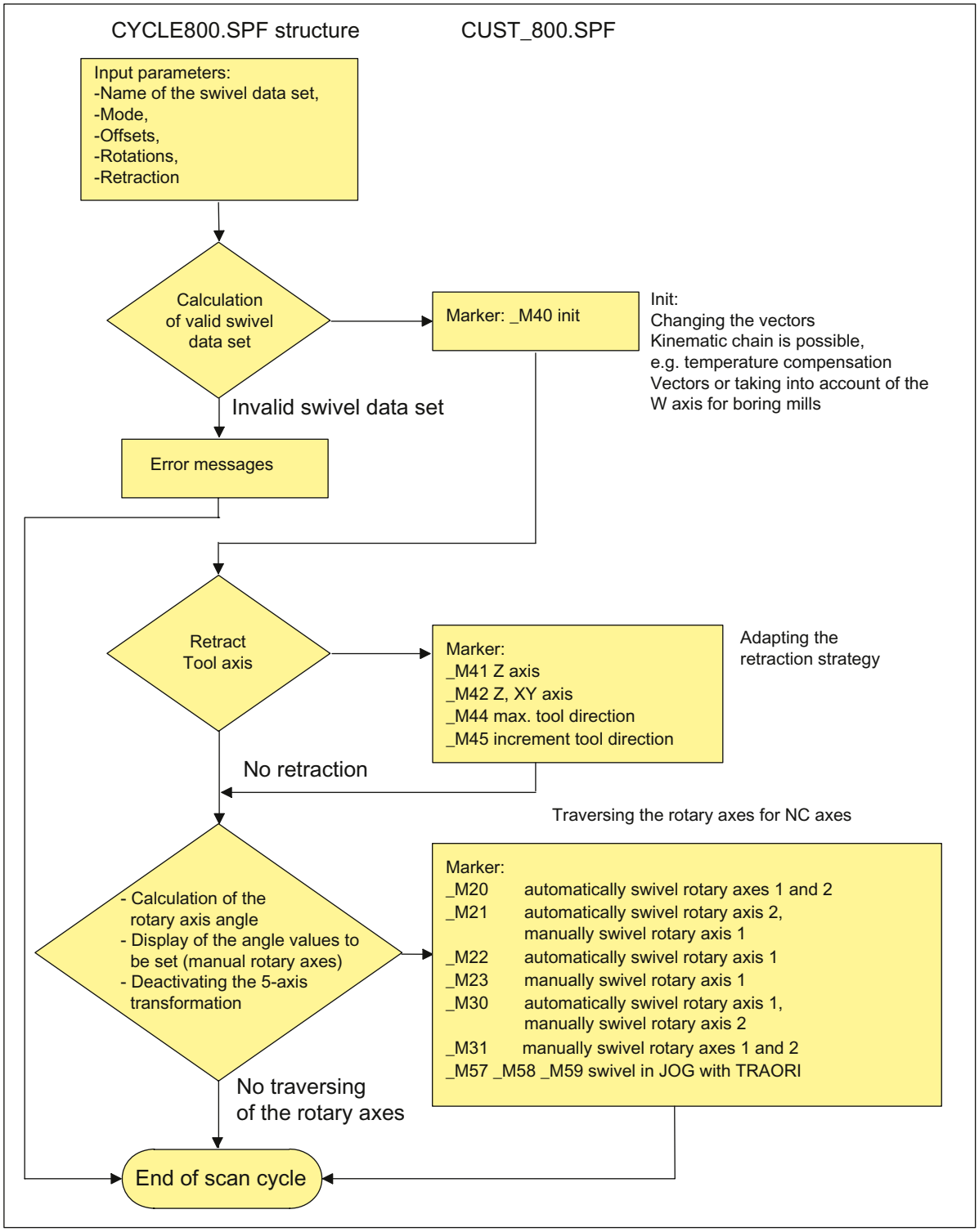


Figure 20-7 Structure: CYCLE800.SPF / CUST_800.SPF

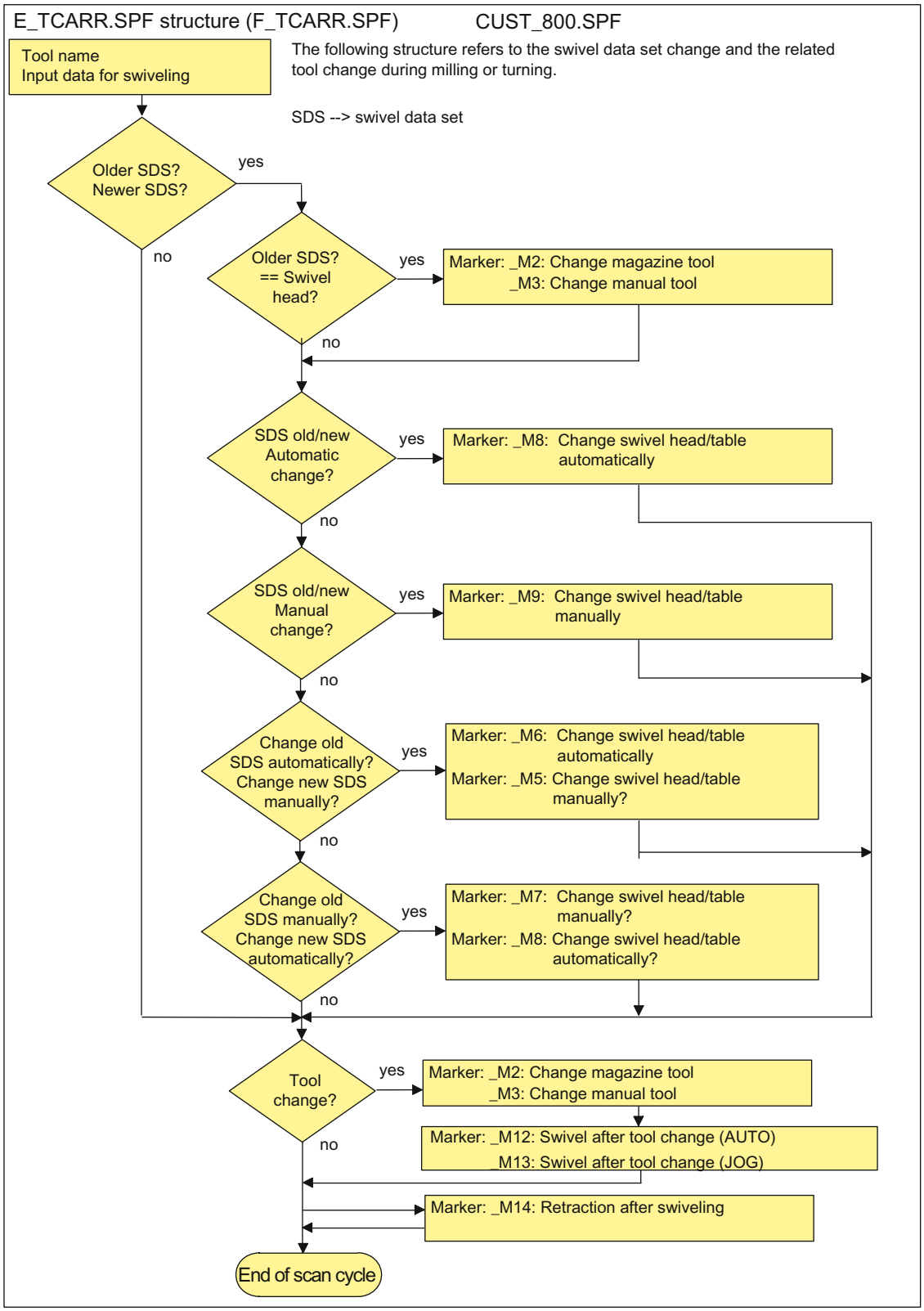


Figure 20-8 Structure: E_TCARR.SPF (F_TCARR.SPF) / CUST_800.SPF

Note on markers _M2 to _M13

When the swivel data set or tool is changed, the linear axes are recovered using the last retraction mode (modal).

If this behavior is not desired in milling/turning, the corresponding calls must be commented out with a semicolon (;). The E_SWIV_H or F_SWIV_H cycle is called in milling/turning (see markers _M2 to _M9) in the CUST_800.SPF manufacturer cycle.

Parameter E_SWIV_H (Par1, Par2, Par3)

- Par1: Number of swivel data set (_TC1)
- Par2: Angle of 1st rotary axis
- Par3: Angle of 2nd rotary axis

Modification examples

If the rotary axes (swivel head/table) are not to be positioned during swivel data change / tool change, the call of the E_SWIV_H cycle can be commented out at the relevant markers. If the rotary axes are to move to a certain position, an angle value can be transferred to parameters Par 2, Par 3.

Note on markers _M14 to _M15

Depending on the values of the retraction plane and the programmed swivel plane, it is possible that the linear axes now also travel the swiveled retraction plane while running up from the current position to the software limit switches after a block search. To avoid this problem, marker _M14 in the CUST_800.SPF is called after swiveling. The E_SP_RP(30) cycle preset there runs up to the milling retraction plane, whereby travel may be along the software limit switches. An appropriate retraction after block search can be set at marker _M15.

Note on the marker _M16

If for a swivel data set change or when de-selecting the swivel data set, you wish to traverse the rotary axes to zero, the syntax of the _M16 marker can be modified accordingly, e.g. activate block N8006 E_SWIV_H(_TC1,0,0).

Note on markers _M20 to _M31

Markers _M20 to _M31 are distinguished by machine kinematics with two rotary axes or one rotary axis. A distinction is also made between automatic rotary axes (known to the NCU) and manual (semi-automatic) rotary axes. There is only ever one valid marker for swiveling with the active swivel data set.

Note on marker _M35

Run through _M35 for block search and a swivel data set with manual rotary axes.

Note on marker _M40

This marker is called before the calculation and activation of the Toollcarrier function as user initialization. This makes it possible for special kinematics, to calculate or rewrite the current vectors of the active swivel data set.

Boring mill application example: For parallel axes, the vector in the Z direction can be updated with the actual value of the W axis.

Note on markers _M41 to _M45

The retraction strategy prior to swiveling the rotary axes can be modified at the markers _M41 to _M45.

Note on marker _M46

Retraction before swiveling after a block search can be set at marker _M46. Variable _E_VER is 1 if it is a milling technology program.

Note on markers _M57 to _M59

Markers _M57 to _M59 are used for swiveling in JOG mode and active 5-axis transformation (TRAORI).

Note on "Correct tool"

“Correct tool” requires that a 5-axis transformation is set up which is equivalent to the corresponding swivel data set. The programming section for "Correct tool" is integrated in the markers _M20, _M21, _M22 and _M30. The first 5-axis transformation is called with TRAORI(1).

Note on tool change + swivel

In general, the swivel (CYCLE800) and tool change functions for a machine are independent of each other. Thus, the swiveled work plane can be retained in a technological sequence with multiple tools, e.g. centering, drilling, tapping.

If the rotary axes of the active swivel data set are involved in the mechanical sequence of the tool change or have to be retracted, this must be taken into account in the tool change program. After the tool change, the rotary axis positions are approached as prior to the tool change. If linear axes (geometry axes) are also involved in the tool change, the rotations in the NC (swivel frame) must not be deleted. Rather, the linear axes can be positioned as machine axes using the G153 or SUPA commands.

Note on swiveling without active tool compensation

If swiveling the rotary axes without active tool cutting edge (D0) is not possible, then you can adapt this in cycle CUST_800.SPF:

```
_M40:
IF ((NOT $P_TOOL) AND _TC1)
 LOOP
 MSG ("no tool cutting edge active")
 M0
 STOPRE
 ENDLOOP
ENDIF
GOTOF_MEND
```

20.6.6 CYCLE996 measure workpiece kinematics

Function

With the Measure kinematics function, it is possible to calculate the geometric vectors used to define the 5-axis transformation (TRAORI and TCARR) by measuring the position of the ball in space.

The measurement is essentially carried out by means of workpiece probes, which scan three positions of a measuring ball on each rotary axis. The ball positions can be defined in accordance with user specifications so that they correspond to the geometric ratios on the machine. The only way of setting the ball positions is to reposition the rotary axis that is to be measured in each case.

Aside from the basic mechanics of the machine, no specific knowledge is required to use CYCLE996. No dimension drawings or machine location diagrams are necessary to carry out measuring.

Application range

The measure kinematics function (CYCLE996) can be used to determine the data that is relevant to transformations in the case of kinematic transformations that involve rotary axes (TRAORI, TCARR).

Options:

- Redetermination of swivel data sets
  - Machine startup
  - Use of swivel-mounted workholders as TCARR
- Checking swivel data sets
  - Service following collisions
  - Checking the kinematics during the machining process

Kinematics with manual axes (manually adjustable rotary tables, swivel-mounted workholders) can be measured in the same way as kinematics with NC-controlled rotary axes.

When CYCLE996 is started, a swivel data set with basic data (for kinematics type) must be parameterized. The measurement itself must be carried out without an active kinematic transformation.

Preconditions

The following requirements must be met in order to use CYCLE996 (Measure kinematics):

- SIEMENS measuring cycles package is installed
- Workpiece probe is calibrated
- Calibration ball is mounted
- Oriented tool carrier is set up (MD18088 MM_NUM_TOOL_CARRIER > 0)
- The basic geometry of the machine (X, Y, Z) is rectangular and referenced

  The right angle refers to the workpiece spindle and should be preferably checked using a test mandrel.
- Defined position of the rotary axes involved in the transformation
- Defined traverse directions in compliance with the standard of all axes involved in the transformation according to ISO 841-2001 and/or DIN 66217 (righthand rule)

The precise procedure when measuring and programming, including examples, is described in the following manual:

References

Programming Manual, Measuring Cycles: CYCLE996

20.7 High-speed machining

20.7.1 High speed settings: Configuring CYCLE832

Function

The High Speed Settings function (CYCLE832) is used to preset data for the machining of sculptured surfaces so that optimum machining is possible. The call of CYCLE832 contains three parameters:

- Tolerance
- Machining type (technology)
- Input of the orientation tolerance

  The 3rd parameter is significant only for machines with multi-axis orientation transformation (TRAORI). By default, it is assigned the value 1.

Software option

You require the software option in order to use this function:

"Advanced Surface"

Tolerance / orientation tolerance

The tolerance value for the linear axes (geometry axes) is transferred to the CNC with the NC command CTOL. CTOL = root(3) * tolerance value.

Tolerance value = 0: The value of the tolerance (CTOL) is loaded from the following SDs:
SD55446 $SCS_MILL_TOL_VALUE_ROUGH
SD55447 $SCS_MILL_TOL_VALUE_SEMIFIN
SD55448 $SCS_MILL_TOL_VALUE_FINISH
Example: CYCLE832(0,_ROUGH,1) → tolerance value from SD55446 is used.

If rotary axes are involved in the machining (multi-axis transformation), the tolerance value is transferred to the CNC with the NC command OTOL.

Two options available for this:

1. Direct entry of the orientation tolerance OTOL

   Machining types: _ORI_ROUGH, _ORI_SEMIFIN, _ORI_FINISH

   To enter the orientation tolerance in the input screen for CYCLE832, bit 1 =1 must be set in the
   setting data SD55220 $SCS_FUNCTION_MASK_MILL_TOL_SET

2. Tolerance is transferred with a factor on the NC command OTOL

   Machining types: _ROUGH, _SEMIFIN, _FINISH

This factor can be set in the following channel-specific setting data for each machining type:

SD55441 $SCS_MILL_TOL_FACTOR_ROUGH	Factor, tolerance of the rotary axes for roughing of the G group 59.
SD55442 $SCS_MILL_TOL_FACTOR_SEMIFIN	Factor, tolerance of the rotary axes for roughing-finishing of the G group 59.
SD55443 $SCS_MILL_TOL_FACTOR_FINISH	Factor, tolerance of the rotary axes for finishing of the G group 59.
= 10	

For machines for which the orientation tolerance is not significant, the cycle setting data SD55441 to 55443 can be set to a value of 0. No orientation tolerance is then calculated in CYCLE832 (OTOL= -1).

Machining type and technology G group 59

The machining types of the technology G group 59 are permanently assigned in CYCLE832 or in CUST_832.SPF:

Machining type	Plain text	Technology G group 59	Field index
Deselection	_OFF	DYNNORM	0
Roughing	_ROUGH	DYNROUGH	2
Rough-finishing	_SEMIFIN	DYNSEMIFIN	3
Finishing	_FINISH	DYNFINISH	4
Roughing *)	_ORI_ROUGH	DYNROUGH	2
Semi-finishing *)	_ORI_SEMIFIN	DYNSEMIFIN	3
Finishing *)	_ORI_FINISH	DYNFINISH	4

*) With entry of an orientation tolerance

Dynamic parameters can be adapted to the respective machining operation with the technology G groups. Using the commands of technology G group 59, the value of the following channel and axis-specific machine data is activated using the corresponding **array index**:

MD20600 $MC_MAX_PATH_JERK[0..4]	Path dependent maximum jerk.
MD20602 $MC_CURV_EFFECT_ON_PATH_ACCEL[0..4]	Influence of path curvature on path dynamic response.
MD20603 $MC_CURV_EFFECT_ON_PATH_JERK[0..4]	Influence of path curvature on path jerk.
MD32300 $MA_MAX_AX_ACCEL[0..4]	Maximum axis acceleration.
MD32310 $MA_MAX_ACCEL_OVL_FACTOR[0..4]	Overload factor for axial velocity jumps.

MD32431 $MA_ MAX_AX_JERK[0..4]	Maximum axial jerk for path motion.
MD32432 $MA_PATH_TRANS_JERK_LIM[0..4]	Maximum axial jerk at the block transition in continuous-path mode.

Note

During the optimization of the machine axes, the values (note array index) of the specified machine data must be set correctly.

Machining type, deselection

When CYCLE832 is deselected, the G groups are programmed for the settings during the program run time; these settings are declared in machine data MD20150 $MC_GCODE_RESET_VALUES[ ]. This involves the G groups 1, 4, 10, 12, 21, 24, 30, 45, 59, 61.

The contour and orientation tolerance is deactivated (CTOL=-1, OTOL=-1).

Manufacturer cycle CUST_832.SPF

In contrast to the settings (G commands) by CYCLE832.SPF, these settings can be modified in the manufacturer cycle CUST_832.SPF. Please proceed as follows:

1. Copy cycle CUST_832.SPF from the directory:
   /NC data/Cycles/Standard cycles
2. Insert cycle CUST_832.SPF into the directory:
   /NC data/Cycles/Manufacturer cycles
3. Open the cycle

The following settings are programmed in CUST_832.SPF:

```
SOFT
COMPCAD
G645
FIFOCTRL
UPATH
;FFWON
```

DYNNORM, DYNFINISH, DYNSEMIFIN, DYNROUGH depending on the machining type.

Corresponding markers are prepared in CUST_832.SPF:

`_M_NORM:`	For deselection _OFF CYCLE832
`_M_FINISH:`	For finishing _FINISH and _ORI_FINISH
`_M_SEMIFINISH:`	For semi-finishing _SEMIFIN and _ORI_SEMIFIN
`_M_ROUGH:`	For roughing _ROUGH and _ORI_ROUGH

The programming of FGREF () is useful when machining with active multi-axis transformation (e.g. TRAORI). In this case, in CUST_832.SPF, variable _FGREF is pre-assigned a value of 10 mm. This value can also be modified. In CYCLE832.SPF, the value of variable _FGREF is written to the rotary axes involved in the machining, which are declared as orientation axis of a 5-axis transformation, using the FGREF(rotary axis) command. When G70/G700 is active, the value from _FGREF is converted into inches before writing to the command FGREF.

Take into account more than three rotary axes (orientation axes) in CYCLE832

In CYCLE832, a maximum of three rotary axes of the orientation transformation (TRAORI) are taken into account for FGREF. If more than three rotary axes are declared per channel for the orientation transformation, you can write the value to FGREF using the following syntax in the CUST_832:

FGREF[AA]=$AA_FGREF[C].

C = rotary axis 1 (axis is taken into account by CYCLE832)
AA = rotary axis 4

20.8 Measuring cycles and functions

20.8.1 Measuring cycles and measurement functions, general

Precondition

Two types of electronic probes are used for measuring:

- Probe to measure the workpiece
- Probe to measure the tool

The electronic probe must be connected to the NCU 7x0.

The electronic probe is only called probe in the following document

References

NCU, Digital Inputs/Outputs Device Manual

Setting the switching behavior

You set the electrical polarity of the connected probe using the following general machine data:

MD13200 $MN_MEAS_PROBE_LOW_ACTIVE	Polarity change of the probe
= 0	Probe in the non-deflected state, 0 V default value Probe in the deflected state, 24 V
= 1	Probe in the non-deflected state, 24 V Probe in the deflected state, 0 V

MD13210 $MN_MEAS_TYPE	Measuring type for distributed drives
= 0	Default value

Testing the probe function

You can test the switching function of the probe by manually deflecting it and checking the following PLC interface signals:

DB 10								
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
DBB107							Probe actuated	
							Probe 2	Probe 1

To test the switching behavior and the measured value transfer, use an NC test program with, for example, the following NC commands:

MEAS	Measurement with deletion of distance-to-go
$AC_MEA[n]	Check the switching operation, n = measurement input number
$AA_MW[axis name]	Measured value of the axes in workpiece coordinates
$AA_MM[axis name]	Measured value of the axes in machine coordinates

Example of a test program

```
Program code                                Comment
%_N_PRUEF_MESSTASTER_MPF                    ;
$PATH=/_N_MPF_DIR                           ; Test program, probe connection
N00 DEF INT MTSIGNAL                        ; Bit memory to check the switching status
N05 G17 G54 T="3D_Taster" D1                ; Select tool geometry for probe
N10 M06                                     ; Activate tool
N15 G0 G90 X0 F150                          ; Starting position and measuring speed
N20 MEAS=1 G1 X100                          ; Measurement at measuring input 1 in the
```

Program code	Comment
	X axis
N30 MTSIGNAL=$AC_MEA[1]	; Switching operation at the 1st measuring input completed, YES / NO
N35 IF MTSIGNAL == 0 GOTOF _FEHL1	; Signal evaluation
N40 R1=$AA_MM[X]	; Save measured value in machine coordinates at R1
N45 R2=$AA_MW[X]	; Save measured value in workpiece coordinates at R2
N50 M0	; Check measured value in R1/R2
N55 M30	
N60 _FEHL1: MSG ("Probe does not switch!")	
N65 M0	
N70 M30	

Precondition

You require at least access level 1 (manufacturer).

From the following general machine data, check the specified minimum assignment:

MD18120 $MN_MM_NUM_GUD_NAMES_NCK	
= 50	Number of global user variable names (SRAM)

MD18130 $MN_MM_NUM_GUD_NAMES_CHAN	
= 350	Number of channel-specific user variable names (SRAM)

MD18150 $MN_MM_GUD_VALUES_MEM	
= 128	Memory space of the global user variable values (SRAM), across all channels

MD18160 $MN_MM_NUM_USER_MACROS	
= 50	Number of macros (DRAM)

MD18170 $MN_MM_NUM_MAX_FUNC_NAMES	
= 400	Number of supplementary functions (cycles, DRAM)

MD18180 $MN_MM_NUM_MAX_FUNC_PARAM	
= 6000	Number of additional parameters for cycles according MD18170

MD18235 $MN_MM_INCOA_MEM_SIZE	
= 20480	Size of the DRAM memory for INCOA applications (kB)

MD18280 $MN_MM_NUM_FILES_PER_DIR	
= 512	Number of files per directory (DRAM)

MD18320 $MN_MM_NUM_FILES_IN_FILESYSTEM	
= 750	Number of files in passive file system (SRAM)

Manufacturer and user cycle CUST_MEACYC.SPF

The CUST_MEACYC.SPF is part of the measuring cycle functionality. It is called in every measuring cycle before and after executing the measurement task. The CUST_MEACYC.SPF acts in the same way when measuring in the JOG mode and measuring in the AUTOMATIC mode.

You can use the CUST_MEACYC.SPF to program and execute sequences that are necessary before and/or after a measurement (e.g. activating/deactivating a probe).

Parameter	Meaning
_MODE	Mode of the manufacturer cycle CUST_MEACYC.SPF 1 = at the beginning of a measuring cycle • refer to the comments at the markers _M976 to _M982 in the CUST_MEACYC 2 = at the end of a measuring cycle • refer to the comments at the markers _M976 to _M982 in the CUST_MEACYC 3 = deactivates function section to the user-specific, activates workpiece probes in conjunction with positioning (SPOS) of the working spindle. • see parameters _SPOS_POS and _SPOS_MOD • see the comment at the marker _MEACYC_MTOFFON in the CUST_MEACYC
_SPOS_POS	Position value of the spindle for _MODE=3 Value range: 0 to 360 degrees
_SPOS_MOD	Spindle positioning mode for _MODE=3 0 = starting the spindle position with SPOS=DC() 1 = starting the spindle position with SPOS=ACP() 2 = starting the spindle position with SPOS=ACN() 3 = starting the spindle position with SPOS=AC() 4 = starting the spindle position with SPOS=IC() 5 = starting the spindle position with SPOS=

Note

_MODE = 3 is only effective, if SD55740 $SCS_MEA_FUNCTION_MASK bit6 is set to 1.

If you modify the cycle CUST_MEACYC.SPF, then proceed as follows:

1. Copy the cycle CUST_MEACYC.SPF from the directory
   NC data/cycles/standard cycles
2. Insert the cycle CUST_MEACYC.SPF into the directory
   NC data/cycles/manufacturer cycles.

General function settings for measuring cycles

Note

After changing this machine data, the probe must be re-calibrated.

20.8.2 Measuring in JOG mode

Preconditions

You have already made the settings from the previous section "Measuring cycles and measurement functions, general (Page 464)".

Workpiece measurement

For milling:

- The probe has been inserted in the tool spindle.
- The probe has been selected in the tool list as type 7xx (probe).
- The probe is activated as tool in the current NC channel.

Setting the general cycle setting data:

SD54780 $SNS_J_MEA_FUNCTION_MASK_PIECE	Settings for the workpiece measurement in JOG input screen.
	For the meaning of the individual bits, please refer to the List Manual Detailed Machine Data Description.

Tool measurement

To measure tools, an appropriate probe must be located in the machine space so that this can be reliably and safely reached with a tool in the spindle.

The following tool types are supported with measure tool:

- Milling technology: Tool types 1xx and 2xx
- Turning technology: Tool type 5xx, 1xx, 2xx

For the specified tool types, the tool lengths and the tool radii can be measured.

Setting general data

SD54782 $SNS_J_MEA_FUNCTION_MASK_TOOL	Settings for the input screen, measuring in JOG, tool measurement.
Bit 2 = 1	Activates the "Enable automatic tool measuring" function.
Bit 3 = 1	Selects the tool probe calibration data field, enable.
Bit 10 = 1	Selects the single cutting edge measurement (tooth breakage check)
Bit 11 = 1	Selects spindle reversal when calibrating in the plane

MD51784 $MNS_J_MEA_T_PROBE_APPR_AX_DIR [i]	
Measuring in JOG: Approach direction in the plane to the tool probe	
-2	Negative direction, 2nd measuring axis
-1	Negative direction, 1st measuring axis (default setting)
0	Positive direction, 1st measuring axis
1	
2	Positive direction, 2nd measuring axis

Checking and setting the general machine data

MD11450 $MN_SEARCH_RUN_MODE	Programming search.
Bit 1 = 1	Automatic ASUB start after output of the action blocks (see also MD11620 $MN_PROG_EVENT_NAME). Alarm 10208 is not output until the ASUB is completed.

MD11604 $MN_ASUP_START_PRIO_LEVEL	Priorities from which ASUP_START_MASK is effective.
= 1 - 64	Priorities for ASUP_START_MASK.

Setting channelspecific machine data

MD20050 $MC_AXCONF_GEOAX_ASIGN_TAB[ ]	Assignment, geometry axis to channel axis.
[0]	For measuring in the JOG mode all of the geometry axes must be available. Preferably XYZ.
[1]	
[2]	

MD20110 $MC_RESET_MODE_MASK	Defines the basic control settings after reset / TP end,
= 4045H	Minimum value
Bit 0 = 1	Basic control setting after power on and reset.
Bit 2 = 1	
Bit 6 = 1	
Bit 14 = 1	

MD20112 $MC_START_MODE_MASK	Definition of the basic control setting after part program start.
= 400H	Minimum value
Bit 6 = 0	Definition of the basic control setting after NC start.

MD20310 $MC_TOOL_MANAGEMENT_MASK	Activating tool manager functions
= 4002H	Minimum value
Bit 1 = 1	Tool manager and monitoring functions active
Bit 14 = 1	Automatic tool change for RESET and Start.

MD28082 $MC_SYSTEM_FRAME_MASK	System frames (SRAM).
Bit 0 = 0	Do not set-up system frames for actual value setting and scratching.
Bit 0 = 1	Set-up system frames for actual value setting and scratching.

The following channel-specific machine data is only effective if the system frame actual value setting and scratching is set up using the above mentioned machine data MD28082 $MC_SYSTEM_FRAME_MASK, bit 0 = 0.

MD24006 $MC_CHSFRAME_RESET_MASK	Active system frames after reset.
Bit 0 = 1	Reset response of the system frames or actual value setting.

MD24007 $MC_CHSFRAME_RESET_CLEAR_MASK	Clear system frames on reset.
Bit 0 = 0	Clear response of the system frames on reset.

Note

If you create the conditions described in this section and you have set and checked the machine setting data, then in the JOG mode, you can measure a workpiece using a workpiece probe at a milling machine!

In the JOG mode, you can measure a tool using a tool probe at a milling machine or lathe!

A description is provided in the following sections as to which settings you can make in order to adapt measuring to the specific requirements of your particular machine.

20.8.2.1 Measuring workpieces in milling

Measuring in the "Machine" operating area can be appropriately adapted to the specific requirements using the following channel-specific general machine data and channel-specific cycle setting data.

General configuration machine data

SD55630 $SCS_MEA_FEED_MEASURE		Calibrating the measuring feedrate for the workpiece probe and measuring the workpiece
300	Default value	

Note

Measuring feedrate for workpiece measuring

All measuring cycles use the value saved in SD54611 as the measuring feedrate value following calibration of the workpiece probe. A different measuring feedrate can be assigned for each calibration field [n].

When calibrating the probe, either the measuring feedrate from SD55630 $SCS_MEA_FEED_MEASURE is used, or the measuring feedrate can be overwritten in the input screen when calibrating. To do this, SD54760 $SNS_MEA_FUNCTION_MASK_PIECE bit 4 must be set to 1.

MD52207 $MCS_AXIS_USAGE_ATTRIB[n]		Attributes of the axes [n] channel axis number
Bit 6	Request rotary axis as offset target for measuring.	
= 0	Default value	
=1	Rotary axis is displayed as correction target in the "Measuring in JOG" window.	

MD51751 $MNS_J_MEA_M_DIST_MANUELL		Measuring path in mm, before and after the measuring point.
= 10	Default value	

MD51757 $MNS_J_MEA_COLL_MONIT_FEED		Position feedrate in mm/min, in the working plane for active collision monitoring.
= 1000	Default value	

MD51758 $MNS_J_MEA_COLL_MONIT_POS_FEED		Position feedrate in mm/min, in the infeed axis for active collision monitoring.
= 1000	Default value	

MD51770 $MNS_J_MEA_CAL_RING_DIAM[n]		Pre-assignment of the calibration diameter in mm specifically for the calibration data sets.
= -1	Default value	

MD51772 $MNS_J_MEA_CAL_HEIGHT_FEEDAX[n]		Pre-assignment of the calibration height in mm, in the infeed axis, specific for the calibration data sets.
= -99999	Default value	

General cycle setting data

SD54780 $SNS_J_MEA_FUNCTION_MASK_PIECE	Configuration of the input screens for measuring in the "Machine" operating area in the JOG operating mode.
= 512	Default value
Bit 2 = 1	Activates measurements with an electronic probe.
Bit 3 = 1	Selects the probe calibration data, enable.
Bit 6 = 1	Selects ZO offset in the basis reference (SETFRAME), enable.
Bit 7 = 1	Selects ZO offset in the channel-specific basic frame, enable.
Bit 8 = 1	Selects ZO offset in the global basic frame, enable.
Bit 9 = 1	Selects ZO offset in adjustable frames, enable.

20.8.2.2 Measuring tools in milling

Measuring feedrate for tool measurement in JOG and AUTOMATIC

SD55628 $SCS_MEA_TP_FEED_MEASURE		Calibrate measuring feedrate for tool probe and tool measurement with stationary spindle.
= 300	Default value	

Note

Measuring feedrate for tool measuring

All measuring cycles use the value saved in SD54636 or SD54651 as the measuring feedrate after the tool probe has been calibrated. A different measuring feedrate can be assigned for each calibration field [n].

When calibrating the probe, either the measuring feedrate from SD55628 SCS_MEA_TP_FEED_MEASURE is used, or the measuring feedrate can be overwritten in the input screen when calibrating. To do this, SD54762 $SNS_MEA_FUNCTION_MASK_TOOL bit 4 must be set to 1.

In the following setting data, index [k] stands for the number of the current data field (probe number -1) of the probe.

SD54633 $SNS_MEA_TP_TYPE[k]	Probe type, cube/disk
= 0	Cube (default value)
= 101	Disk in XY, working plane G17
= 201	Disk in ZX, working plane G18
= 301	Disk in YZ, working plane G19

The following setting data is used to define in which axes and directions it is possible to calibrate a tool probe.

SD54632 $SNS_MEA_T_PROBE_ALLOW_AX_DIR[k]		Axes and directions for "calibration"
= 133	Default value	

Decimal place		
ONES	1. 1st axis	
	= 0	axis not possible
	= 1	only minus direction
	= 2	only plus direction
	= 3	both directions

Decimal place			
TENS	2. 2nd axis		
		= 0	axis not possible
		= 1	only minus direction
		= 2	only plus direction
		= 3	both directions
HUNDREDS	3. 3rd axis		
		= 0	axis not possible
		= 1	only minus direction
		= 2	only plus direction
		= 3	both directions

Example

If the general setting data SD54632 $SNS_MEA_T_PROBE_ALLOW_AX_DIR[k] has the value 123, the tool probe is calibrated as follows in the G17 plane:

- X in both directions
- Y only in plus direction
- Z only in minus direction

SD54631 $MNS_MEA_T_PROBE_DIAM_LENGTH[k]		Effective diameter of the tool probe for length measurement.
= 0	Default value	

General cycle machine/setting data for tool probe

MD51780 $MNS_J_MEA_T_PROBE_DIAM_RAD[k]		Effective diameter of the tool probe for radius measurement.
= 0	Default value	

SD54634 $SNS_MEA_TP_CAL_MEASURE_DEPTH[n]		Distance between the tool probe upper edge and the milling tool lower edge.
= 2	Default value	

MD51752 $MNS_J_MEA_M_DIST_TOOL_LENGTH		Measuring path to measure the tool length.
= 2	Default value	

MD51753 $MNS_J_MEA_M_DIST_TOOL_RADIUS		Measuring path to measure the tool radius.
= 1	Default value	

MD51786 $MNS_J_MEA_T_PROBE_MEASURE_DIST		Measuring path to calibrate the probe or for measurements with stationary spindle.
= 10	Default value	

General cycle setting data when measuring with rotating spindle

SD54670 $SNS_MEA_CM_MAX_PERI_SPEED[0]		Maximum permissible peripheral speed of the tool to be measured.
= 100	Default value	

SD54671 $SNS_MEA_CM_MAX_REVOLUTIONS[0]		Maximum permissible tool speed of the tool to be measured. The speed is automatically reduced when exceeded.
= 1000	Default value	

SD54672 $SNS_MEA_CM_MAX_FEEDRATE[0]		Maximum permissible feedrate to probe the tool to be measured at the probe.
= 20	Default value	

SD54673 SNS_MEA_CM_MIN_FEEDRATE[0]		Minimum feedrate for the first probing of the tool to be measured at the probe. The avoids excessively small feedrates for large tool radii.
= 1	Default value	

SD54674 $SNS_MEA_CM_SPIND_ROT_DIR[0]		Spindle direction of rotation to measure tools.
= 4	Spindle rotation the same as M4 (default value)	

NOTICE
If the spindle is already rotating when the measuring cycle is called, this direction of rotation remains independent of the setting of this data.

SD54675 $SNS_MEA_CM_FEEDFACTOR_1[0]	Feedrate factor 1
= 10	Default value
= 0	Only single probing with the feedrate calculated by the cycle. However, as a minimum, the value from SD54673[0] $SNS_MEA_CM_MIN_FEEDRATE.
>= 1	First probing with feedrate. However, as a minimum with the value from SD54673[0] $SNS_MEA_CM_MIN_FEEDRATE) SD54675[0] $SNS_MEA_CM_FEEDFACTOR_1

SD54676 $SNS_MEA_CM_FEEDFACTOR_2[0]	Feedrate factor 2
= 0	Second probing with the feedrate calculated by the measuring cycle. This is only effective for SD54673[0] $SNS_MEA_CM_FEEDFACTOR_1 > 0, default value
>= 1	Second probing with the feedrate from SD54673[0] $SNS_MEA_CM_MIN_FEEDRATE feedrate factor 2. Third probing with the calculated feedrate.

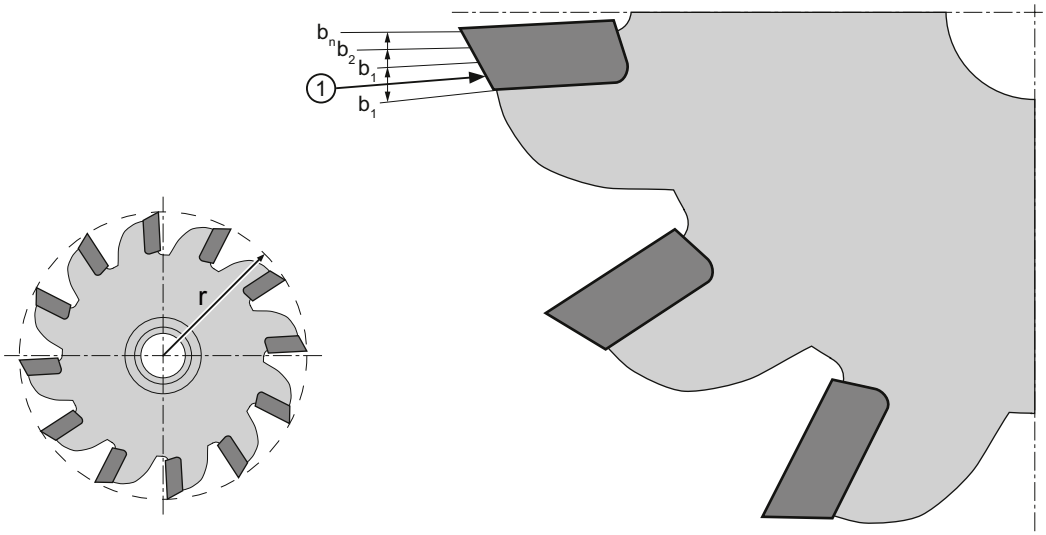
NOTICE
Feedrate factor 2 should be less than feedrate factor 1.

SD54677 $SNS_MEA_CM_MEASURING_ACCURACY[0]	Specified measuring accuracy. The value of this parameter always refers to the last probing of the tool at the probe!
= 0.005	Default value

SD54692 $SNS_MEA_T_CIRCULAR_ARC_DIST	Arc distance for the single cutting edge measurement of the radius.
= 0.25 *)	Default value

SD54693 $SNS_MEA_T_MAX_STEPS	Maximum number of probe contacts for single cutting edge measurement of the radius.
= 10 *)	Default value

*) If the value = 0, then the "highest point on the longest cutting edge" is not sought, but the measured value of the contact with the rotating spindle taken.



r Effective radius of the tool
b Arc distance = SD54692
n Maximum number of probe contacts = SD54693
① 1. Measuring point

Figure 20-9 Single cutting edge measurement

General cycle setting data for correction using the correction tables when forming measurements with rotating spindle.

SD54691 $SNS_MEA_T_PROBE_OFFSET	Activate the measuring result compensation
= 0	No data, default value
= 1	Correction in the cycle. This is only effective if SD54689 $SNS_MEA_T_PROBE_MANUFACTURER>0.
= 2	Correction using user-defined correction table

SD54689 $SNS_MEA_T_PROBE_MANUFACTURER	Activates pre-configured compensation tables for several tool probe models (customer-specific)
= 0	No data, default value
= 1	TT130 (Heidenhain)
= 2	TS27R (Renishaw)

General cycle setting data of the compensation tables

If the general cycle setting data SD54691 $SNS_MEA_T_PROBE_OFFSET= 2, the following settings apply:

SD54695 to SD54700	Compensation value for radius measurement	See the subsequent general cycle setting data.
SD54705 to SD54710	Compensation values for length measurement	See the subsequent general cycle setting data.

SD54695 $SNS_MEA_RESULT_OFFSET_TAB_RAD1[n] SD54705 $SNS_MEA_RESULT_OFFSET_TAB_LEN1[n]	Radius measurement Length measurement
= 0	0
= 1	1. 1st radius
= 2	2. 2nd radius
= 3	3. 3rd radius
= 4	4. Radius

SD54696 $SNS_MEA_RESULT_OFFSET_TAB_RAD2[n] SD54706 $SNS_MEA_RESULT_OFFSET_TAB_LEN2[n]	Radius measurement Length measurement
= 0	1. 1st peripheral speed
= 1	Correction value for 1st radius/ length measurement
= 2	Correction value for 2nd radius/ length measurement
= 3	Correction value for 3rd radius/ length measurement
= 4	Correction value for 4th radius/ length measurement

SD54697 $SNS_MEA_RESULT_OFFSET_TAB_RAD3[n] SD54707 $SNS_MEA_RESULT_OFFSET_TAB_LEN3[n]	Radius measurement Length measurement
= 0	2. 2nd peripheral speed
= 1	Correction value for 1st radius/ length measurement
= 2	Correction value for 2nd radius/ length measurement
= 3	Correction value for 3rd radius/ length measurement
= 4	Correction value for 4th radius/ length measurement

SD54698 $SNS_MEA_RESULT_OFFSET_TAB_RAD4[n] SD54708 $SNS_MEA_RESULT_OFFSET_TAB_LEN4[n]	Radius measurement Length measurement
= 0	3. 3rd peripheral speed
= 1	Correction value for 1st radius/ length measurement
= 2	Correction value for 2nd radius/ length measurement

= 3	Correction value for 3rd radius/ length measurement
= 4	Correction value for 4th radius/ length measurement

SD54699 $SNS_MEA_RESULT_OFFSET_TAB_RAD5[n] SD54709 $SNS_MEA_RESULT_OFFSET_TAB_LEN5[n]	Radius measurement Length measurement
= 0	4. 4th peripheral speed
= 1	Correction value for 1st radius/ length measurement
= 2	Correction value for 2nd radius/ length measurement
= 3	Correction value for 3rd radius/ length measurement
= 4	Correction value for 4th radius/ length measurement

SD54700 $SNS_MEA_RESULT_OFFSET_TAB_RAD6[n] SD54710 $SNS_MEA_RESULT_OFFSET_TAB_LEN6[n]	Radius measurement Length measurement
= 0	5. 5th peripheral speed
= 1	Correction value for 1st radius/ length measurement
= 2	Correction value for 2nd radius/ length measurement
= 3	Correction value for 3rd radius/ length measurement
= 4	Correction value for 4th radius/ length measurement

20.8.2.3 Measuring tools for turning

Measuring feedrate for tool measurement in turning operation

SD55628 $SCS_MEA_TP_FEED_MEASURE	Calibrate measuring feedrate for tool probe and tool measurement with stationary spindle.
= 300	Default value

Note

Measuring feedrate for tool measuring

All measuring cycles use the value saved in SD54636 or SD54651 as the measuring feedrate after the tool probe has been calibrated. A different measuring feedrate can be assigned for each calibration field [n].

When calibrating the probe, either the measuring feedrate from SD55628 is used, or the measuring feedrate can be overwritten in the input screen when calibrating. To do this, SD54762 $SNS_MEA_FUNCTION_MASK_TOOL bit 4 must be set to 1.

General cycle machine/setting data for measuring path/feedrate

SD42950 $SC_TOOL_LENGTH_TYP		Assignment of the tool length offset independent of tool type.
= 0	Measuring turning tools, type 5xx (default value)	
= 2	Measuring turning tools, type 5xx, drilling and milling tools, type 1xx, 2xx	

MD51786 $MNS_J_MEA_T_PROBE_MEASURE_DIST		Measuring path to calibrate the probe or for measurements with stationary spindle.
= 10	Default value	

SD55628 $SCS_MEA_TP_FEED_MEASURE		Feedrate for the calibration of a tool probe with stationary spindle.
= 300	Default value	

Calibrating tool probes

Use the following general cycle machine data to set the access level as of which the "Calibrate probe" softkey is displayed. This requires that the automatic tool measurement is enabled using the setting data SD54782 (bit 2 = 1).

MD51070 $MNS_ACCESS_CAL_TOOL_PROBE		Calibrate tool probe access level.
= 7	Access rights: Access level 7 (keyswitch 0)	
= 4	Read access rights: Access level 4 (keyswitch 3), default value	
= 3	Write access: Access level 3 (user)	

Note

Measuring feedrate for tool measuring

All measuring cycles use the value saved in SD54636 or SD54651 as the measuring feedrate after the tool probe has been calibrated.

A different measuring feedrate can be assigned for each calibration field [n].

When calibrating the probe, either the measuring feedrate from SD55628 is used, or the measuring feedrate can be overwritten in the input screen when calibrating. To do this, SD54762 $SNS_MEA_FUNCTION_MASK_TOOL bit 4 must be set to 1.

20.8.2.4 Measuring behind the turning center

Working with two toolholders

It is possible to work on a single turning machine with two toolholders, both of which are mounted on an X axis. The toolholders may be revolvers, multifix, or a combination of both. Since both tool adapters are mounted on the same axis, it is only ever possible to work with one tool at a time. The workpiece is located between the two tool adapters.

All tools have the same reference point (on toolholder 1) irrespective of which toolholder they are on. For this reason, the tool lengths of the second toolholder are always longer than the tools on the first toolholder. The main machining is performed in the negative X axis direction.

Note

If there are a large number of old G code programs that were programmed without mirroring of the X axis, you should consider setting mirroring for G code programs.

If the corresponding mode of operation of the second toolholder (with mirroring of the X axis) is also to be used for G code programs, then additional settings must be configured.

To automatically activate the mirroring when loading tools to the second toolholder, the following T replacement must be set:

MD10717 $MN_T_NO_FCT_CYCLE_NAME="F_T_REV2"

If the required mirroring is also to be automatically activated when programming the TRANSMIT command, the TRANSMIT command must be replaced by a subprogram (e.g. in the manufacturer directory):

```
MD10712 $MN_NC_USER_CODE_CONF_NAME_TAB[0]="TRANSMIT"

MD10712 $MN_NC_USER_CODE_CONF_NAME_TAB[1]="TRANSM"

TRANSMIT.SPF

PROC TRANSMIT(INT_NR)

F_T_REV2

TRANSM(_NR)

F_T_REV2

RET
```

Note

In the status display, TRANSM is now displayed instead of TRANSMIT.

20.8.2.5 Measuring without electronic probe in JOG

Measure workpiece

For manual measuring functions in the JOG operating mode, for which a rotating spindle is required, the following applies:

- The channel state must be reset at the instant in time that the measured value is transferred.
- The spindle can be moved or positioned either using the T,S,M menu or using the bits in DB3x.DBB30.
- The following preconditions apply when using the DB3x.DBB30 technology functions with fixed speed:

Setting the machine data		
MD10709 $MN_PROG_SD_POWERON_INIT_TAB [0] = 0		setting data to be initialized
MD35035 $MA_SPIND_FUNCTION_MASK	Bit 4=0 Bit 5=1	Spindle functions
SD43200 $SA_SPIND_S		Speed setting value

NOTICE
The entry in SD43200 $SA_SPIND_S is kept at power on. With these settings, the spindle velocity for manual operation, which is set in SD41200 $SN_JOG_SPIND_SET_VELO, is no longer effective.

20.8.3 Measuring in AUTOMATIC mode

Precondition

Software option

In order to use the "Measuring in AUTOMATIC" function, you require the software option: "Measuring cycles"

You have already made the settings from Chapter "Measuring cycles and measurement functions, general (Page 464)".

Workpiece measurement

Sequence in milling technology:

1. The probe has been selected in the tool list as type 7xx (probe).
2. The probe has been inserted in the tool spindle.
3. Probe is activated in the actual NC channel.

Sequence in turning technology:

1. Tool type 580 (3D probe, turning) is selected.
2. Tool is activated in the actual NC channel.

Tool measurement

To measure tools, an appropriate probe must be located in the machine space so that this can be reliably and safely reached with a tool in the spindle.

The following tool types are supported with measure tool:

- Milling technology: Tool types 1xx and 2xx
- Turning technology: Tool type 5xx, 1xx, 2xx

For the specified tool types, the tool lengths and the tool radii can be measured.

Channel-specific cycle setting data

Using the following channel-specific cycle setting data, you can adapt the **workpiece and tool measuring** in the "Program" operating area to specific requirements. As a general rule, no changes are required.

SD55613 $SCS_MEA_RESULT_DISPLAY	Selects the screen display of the measuring result
= 0	No screen display of the measuring result (default value).
= 1	Screen display of the measuring result is displayed for 8 seconds.
= 3	The measuring cycle stops an internal machine data, the measuring result is statically displayed on the screen! Continue with NC start, the measuring result screen is deselected.
= 4	The measuring result is only displayed on the screen for cycle alarms 61303, 61304, 61305, 61306. Continue with NC start, the measuring result display on the screen is deselected.

SD55623 $SCS_MEA_EMPIRIC_VALUE[n]	Empirical values
= 0	Default value

SD55618 $SCS_MEA_SIM_ENABLE	Measuring cycle simulation
= 0	When calling measuring cycles in conjunction with SINUMERIK Operate, ShopMill or ShopTurn simulation, the measuring cycles are skipped, default value.
= 1	Default setting: When calling measuring cycles in conjunction with SINUMERIK Operate, ShopMill or ShopTurn simulation, the measuring cycles are run through. However, no corrections are performed and there is no logging. There is no screen display of the measuring result.

Configuring input screens for measuring cycles in the program editor

Using the following setting data, you configure the display screen and the correction options when making measurements in the AUTOMATIC mode:

- SD54760 $SNS_MEA_FUNCTION_MASK_PIECE measure workpiece: Measuring cycles in the milling area
- SD54762 $SNS_MEA_FUNCTION_MASK_TOOL measure tool: Measuring cycles in the milling area

Note

If you have created the prerequisites described in this chapter and you have set and checked the machine/setting data, you can perform measurements at the machine with a workpiece or tool probe in the AUTOMATIC mode!

If you wish to set-up workpiece measurement on a lathe, then additional settings are required. Refer to the Chapter "Measuring workpieces in turning (Page 494)" for the settings.

If you wish to set-up tool measurement using a tool probe, then you must also make additional settings. Please refer to the Chapters "Measuring tools for turning (Page 495)" or "Tool measurement in milling (Page 487)" for the settings.

A description is provided in the following chapters as to which settings you can make in order to adapt measuring to the specific requirements of your particular machine.

20.8.3.1 Workpiece measurement, general

Using the following general and channel-specific cycle setting data, you can appropriately adapt workpiece measurement to the specific requirements in the "Program" operating area.

Precondition

You have already made the settings from the following section:

See also: Measuring cycles and measurement functions, general (Page 464)

Settings

General cycle setting data

SD54760 $SNS_MEA_FUNCTION_MASK_PIECE		Settings for the input screen, measuring cycles in AUTOMATIC, workpiece measurement.
	For the meaning of the individual bits, please refer to the List Manual Detailed Machine Data Description.	

Channel-specific cycle setting data

SD55630 $SCS_MEA_FEED_MEASURE		Measuring feedrate [mm/rev]
= 300	Measuring feedrate when calibrating the workpiece probe	

Note

Measuring feedrate for workpiece measuring

All measuring cycles use the value saved in SD54611 $SNS_MEA_WP_FEED[n] as measuring feedrate after the tool probe has been calibrated.

A different measuring feedrate can be assigned for each calibration field [n].

When calibrating the probe, either the measuring feedrate from SD55630 $SCS_MEA_FEED__MEASURE is used, or the measuring feedrate can be overwritten in the input screen when calibrating. To do this, SD54760 MEA_FUNCTION_MASK_PIECE bit 4 must be set to 1.

SD55632 $SCS_MEA_FEED_RAPID_IN_PERCENT		Percentage reduction
= 50	Default value of the percentage reduction of the rapid traverse velocity for internal cycle intermediate positioning without collision monitoring. The setting of the channel-specific cycle setting data SD55600 SCS_MEA_COLLISION_MONITORING must be = 0.	

SD55634 $SCS_MEA_FEED_PLANE_VALUE		Feedrate of the intermediate positioning in the working plane with active collision monitoring.
= 1000	Default value	

SD55636 $SCS_MEA_FEED_FEEDAX_VALUE		Feedrate of the intermediate positioning in the infeed axis with active collision monitoring.
= 1000	Default value	

SD55638 $SCS_MEA_FEED_FAST_MEASURE	Fast measuring feedrate
= 900	Default value

SD55640 $SCS_MEA_FEED_CIRCLE	Feedrate with circle programming
= 1000	Default value

SD55642 $SCS_MEA_EDGE_SAVE_ANG	Safety angle when measuring corner (CYCLE961)
= 0	Degrees

20.8.3.2 Workpiece measurement in milling

Measuring in the "Program" operating area can be adapted corresponding to the specific requirements using the channel-specific cycle setting data.

Settings

SD55625 $SCS_MEA_AVERAGE_VALUE[n]	Number of mean values.
= 0	Default value

The following cycle setting data are written to by the measuring cycles with the "Calibrate probe" measuring function. User parameterization is not necessary here. However, after the probe has been calibrated, you can check these values and if required, evaluate the probe quality, e.g. for position deviations, no values > 0.1 mm should be reached. Otherwise, the probe must be mechanically readjusted.

The measuring feedrate at the time of calibration is used for all subsequent applications of the measuring cycles.

Note

Observe the manufacturer's instructions for the probe.

SD54600 $SNS_MEA_WP_BALL_DIAM[n]	Effective diameter of the probe ball of the workpiece probe.
SD54601 $SNS_MEA_WP_TRIG_MINUS_DIR_AX1[n]	Trigger point, minus direction, 1st measuring axis in the plane.
SD54602 $SNS_MEA_WP_TRIG_PLUS_DIR_AX1[n]	Trigger point, plus direction, 1st measuring axis in the plane.

SD54603 $SNS_MEA_WP_TRIG_MINUS_DIR_AX2[n]	Trigger point, minus direction, 2nd measuring axis in the plane.
SD54604 $SNS_MEA_WP_TRIG_PLUS_DIR_AX2[n]	Trigger point, plus direction, 2nd measuring axis in the plane.
SD54605 $SNS_MEA_WP_TRIG_MINUS_DIR_AX3[n]	Trigger point, minus direction, 3rd measuring axis in the tool direction.
SD54606 $SNS_MEA_WP_TRIG_PLUS_DIR_AX3[n]	Trigger point, plus direction, 3rd measuring axis opposite to the tool direction. In the default case = 0.
SD54607 $SNS_MEA_WP_POS_DEV_AX1[n]	Position deviation, 1st measuring axis in the plane.
SD54608 $SNS_MEA_WP_POS_DEV_AX2[n]	Position deviation, 2nd measuring axis in the plane.
SD54610 $SNS_MEA_WP_STATUS_GEN[n]	Calibration status
SD54611 $SNS_MEA_WP_FEED[n]	Measuring feedrate when calibrating

20.8.3.3 Tool measurement in milling

Calibration data of the tool probe, referred to the machine coordinate system

Before calibration is started, the position of the tool probe in the machine coordinate system (MCS) must be entered into the following general cycle setting data. In this case, the reference point is the outer diameter or the tool length of the active tool in the spindle. If there is no tool in the spindle, the reference points are the spindle center point and the tool reference point at the spindle.

Note

Calibrate probe

If you have calibrated the tool probe in JOG mode, then the calibration data have already been correctly entered in: SD54632 $SNS_MEA_TP_AX_DIR_AUTO_CAL[k]

Index [k] stands for the number of the actual data field (probe number -1).

SD54625 $SNS_MEA_TP_TRIG_MINUS_DIR_AX1[k]	Trigger point of the 1st measuring axis in the negative direction.
SD54626 $SNS_MEA_TP_TRIG_PLUS_DIR_AX1[k]	Trigger point of the 1st measuring axis in the positive direction.
SD54627 $SNS_MEA_TP_TRIG_MINUS_DIR_AX2[k]	Trigger point of the 2nd measuring axis in the negative direction.
SD54628 $SNS_MEA_TP_TRIG_PLUS_DIR_AX2[k]	Trigger point of the 2nd measuring axis in the positive direction.
SD54629 $SNS_MEA_TP_TRIG_MINUS_DIR_AX3[k]	Trigger point of the 3rd measuring axis in the negative direction.

SD54630 $SNS_MEA_TP_TRIG_PLUS_DIR_AX3[k]	Trigger point of the 3rd measuring axis in the positive direction.
SD54631 $SNS_MEA_TP_EDGE_DISK_SIZE[k]	Tool probe, edge length / disk diameter.
SD54632 $SNS_MEA_TP_AX_DIR_AUTO_CAL[k]	Axes and directions for calibrating in AUTOMATIC mode.
SD54634 $SNS_MEA_TP_CAL_MEASURE_DEPTH[k]	Distance between the upper edge of the tool probe and lower edge of the tool (calibration depth, measuring depth for milling radius).
SD54635 $SNS_MEA_TPW_STATUS_GEN[k]	Calibration status
SD54636 $SNS_MEA_TPW_FEED[k]	Measuring feedrate during calibration

The general cycle setting data SD54632 $SNS_MEA_TP_AX_DIR_AUTO_CAL, is used to define in which axes and directions it is possible to calibrate the tool probe.

Decimal place		
ONES	1st axis	
	= 0	axis not possible
	= 1	only minus direction
	= 2	only plus direction
	= 3	both directions
TENS	2nd axis	
	= 0	axis not possible
	= 1	only minus direction
	= 2	only plus direction
	= 3	both directions
HUNDREDS	3rd axis	
	= 0	axis not possible
	= 1	only minus direction
	= 2	only plus direction
	= 3	both directions

Example

If the general cycle machine data SD54632 $SNS_MEA_TP_AX_DIR_AUTO_CAL has the value 123, the tool probe is calibrated as follows in the G17 plane:

- X in both directions
- Y only in plus direction
- Z only in minus direction

SD54633 $SNS_MEA_TP_TYPE[k]	Probe version
= 0	Cube, default value.
= 101	Disk in XY, working plane G17.

= 201	Disk in ZX, working plane G18.
= 301	Disk in YZ, working plane G19.

Calibration data of the tool probe referred to the workpiece coordinate system

Before calibration is started, the position of the tool probe in the workpiece coordinate system (WCS) must be roughly entered into the following general cycle setting data. In this case, the reference point is the outer diameter or the tool length of the active tool in the spindle. If there is no tool in the spindle, the reference points are the spindle center point and the tool reference point at the spindle.

Note

When measuring tools, ensure that the data of the adjustable work offset or the basic reference always correspond to the data when calibrating (measuring in WCS!).

Always make measurements and calibrate with the same adjustable work offset.

SD54640 $SNS_MEA_TPW_TRIG_MINUS_DIR_AX1[k]	Trigger point of the 1st measuring axis in the negative direction.
SD54641 $SNS_MEA_TPW_TRIG_PLUS_DIR_AX1[k]	Trigger point of the 1st measuring axis in the positive direction.
SD54642 $SNS_MEA_TPW_TRIG_MINUS_DIR_AX2[k]	Trigger point of the 2nd measuring axis in the negative direction.
SD54643 $SNS_MEA_TPW_TRIG_PLUS_DIR_AX2[k]	Trigger point of the 2nd measuring axis in the positive direction.
SD54644 $SNS_MEA_TPW_TRIG_MINUS_DIR_AX3[k]	Trigger point of the 3rd measuring axis in the negative direction.
SD54645 $SNS_MEA_TPW_TRIG_PLUS_DIR_AX3[k]	Trigger point of the 3rd measuring axis in the positive direction.
SD54646 $SNS_MEA_TPW_EDGE_DISK_SIZE[k]	Tool probe, edge length / disk diameter.
SD54647 $SNS_MEA_TPW_AX_DIR_AUTO_CAL[k]	Automatic calibration of tool probe, enable axes/directions
SD54648 $SNS_MEA_TPW_TYPE[k]	Probe version
= 0	Cube (default value)
= 101	Disk in XY, working plane G17.
= 201	Disk in ZX, working plane G18.
= 301	Disk in YZ, working plane G19.
SD54649 $SNS_MEA_TPW_CAL_MEASURE_DEPTH[k]	Distance between the upper edge of the tool probe and lower edge of the tool (calibration depth, measuring depth for milling radius).
SD54650 $SNS_MEA_TPW_STATUS_GEN[k]	Calibration status
SD54651 $SNS_MEA_TPW_FEED[k]	Measuring feedrate during calibration

The following general cycle setting data SD54647 $SNS_MEA_TPW_AX_DIR_AUTO_CAL is used to define in which axes and directions it is possible to calibrate a tool probe.

Decimal place		
ONES	1. Axis	
	= 0	axis not possible
	= 1	only minus direction
	= 2	only plus direction
	= 3	both directions
TENS	2. Axis	
	= 0	axis not possible
	= 1	only minus direction
	= 2	only plus direction
	= 3	both directions
HUNDREDS	3. Axis	
	= 0	axis not possible
	= 1	only minus direction
	= 2	only plus direction
	= 3	both directions

Example

If the general cycle machine data SD54647 $SNS_MEA_TPW_AX_DIR_AUTO_CAL has the value 123, the tool probe is calibrated as follows in the G17 plane:

- X in both directions
- Y only in plus direction
- Z only in minus direction

Monitoring when measuring with a rotating spindle

SD54670 $SNS_MEA_CM_MAX_PERI_SPEED[0]		Maximum permissible peripheral speed of the tool to be measured.
= 100	Default value	

SD54671 $SNS_MEA_CM_MAX_REVOLUTIONS[0]		Maximum permissible tool speed of the tool to be measured. The speed is automatically reduced when exceeded.
= 1000	Default value	

SD54672 $SNS_MEA_CM_MAX_FEEDRATE[0]		Maximum permissible feedrate to probe the tool to be measured at the probe.
= 20	Default value	

SD54673 $SNS_MEA_CM_MIN_FEEDRATE[0]		Minimum feedrate for the first probing of the tool to be measured at the probe. The avoids excessively small feedrates for large tool radii.
= 1	Default value	

SD54674 $SNS_MEA_CM_SPIND_ROT_DIR[0]		Spindle direction of rotation to measure tools.
4 = M4	Default value	

NOTICE
If the spindle is already rotating when the measuring cycle is called, this direction of rotation remains independent of the setting of this data.

SD54675 $SNS_MEA_CM_FEEDFACTOR_1[0]	Feedrate factor 1
= 10	Default value
= 0	Only single probing with the feedrate calculated by the cycle. However, as a minimum, the value from SD54673[0] $SNS_MEA_CM_MIN_FEEDRATE.
= ≥ 1	First probing with feedrate. However, as a minimum with the value from SD54673[0] $SNS_MEA_CM_MIN_FEEDRATE) SD54675[0] $SNS_MEA_CM_FEEDFACTOR_1

SD54676 $SNS_MEA_CM_FEEDFACTOR_2[0]	Feedrate factor 2
= 0	Second probing with the feedrate calculated by the cycle. This is only effective for SD54673 $SNS_MEA_CM_FEEDFACTOR_1[0] > 0, default value.
= ≥ 1	Second probing with the calculated feedrate from SD54673 $SNS_MEA_CM_MIN_FEEDRATE[0] feedrate factor 2. Third probing with the calculated feedrate.

NOTICE
Feedrate factor 2 should be less than feedrate factor 1.

SD54677 $SNS_MEA_CM_MEASURING_ACCURACY[0]		Specified measuring accuracy. The value of this parameter always refers to the last probing of the tool at the probe.
= 0.005	Default value	

Measurement with rotating spindle: Measured value correction using correction tables

SD54691 $SNS_MEA_T_PROBE_OFFSET	Activates the measuring result correction
= 0	No data, default value
= 1	Correction in the cycle. This is only effective if SD54690 $SNS_MEA_T_PROBE_MANUFACTURER>0.
= 2	Correction using user-defined correction table

SD54689 $SNS_MEA_T_PROBE_MANUFACTURER	Activate pre-configured compensation tables for several tool probe models (customer-specific).
= 0	No data, default value
= 1	TT130 (Heidenhain)
= 2	TS27R (Renishaw)

Correction values for users

If the general cycle setting data SD54691 $SNS_MEA_T_PROBE_OFFSET= 2, the following settings apply:

SD54695 to SD54700	Correction values for radius measurement.	See the subsequent general cycle setting data.
SD54705 to SD54710	Correction values for length measurement.	See the subsequent general cycle setting data.

SD54695 $SNS_MEA_RESULT_OFFSET_TAB_RAD1[n] SD54705 $SNS_MEA_RESULT_OFFSET_TAB_LEN1[n]	Radius measurement Length measurement
= 0	0
= 1	1. Radius
= 2	2. Radius
= 3	3. Radius
= 4	4. Radius

SD54696 $SNS_MEA_RESULT_OFFSET_TAB_RAD2[n] SD54706 $SNS_MEA_RESULT_OFFSET_TAB_LEN2[n]	Radius measurement Length measurement
= 0	1st peripheral speed.
= 1	Correction value for 1st radius/length measurement.
= 2	Correction value for 2nd radius/length measurement.
= 3	Correction value for 3rd radius/length measurement.
= 4	Correction value for 4th radius/ length measurement.

SD54697 $SNS_MEA_RESULT_OFFSET_TAB_RAD3[n] SD54707 $SNS_MEA_RESULT_OFFSET_TAB_LEN3[n]	Radius measurement Length measurement
= 0	2. peripheral speed.
= 1	Correction value for 1st radius/length measurement.
= 2	Correction value for 2nd radius/length measurement.
= 3	Correction value for 3rd radius/length measurement.
= 4	Correction value for 4th radius/ length measurement.

SD54698 $SNS_MEA_RESULT_OFFSET_TAB_RAD4[n] SD54708 $SNS_MEA_RESULT_OFFSET_TAB_LEN4[n]	Radius measurement Length measurement
= 0	3. peripheral speed.
= 1	Correction value for 1st radius/length measurement.
= 2	Correction value for 2nd radius/length measurement.
= 3	Correction value for 3rd radius/length measurement.
= 4	Correction value for 4th radius/ length measurement.

SD54699 $SNS_MEA_RESULT_OFFSET_TAB_RAD5[n] SD54709 $SNS_MEA_RESULT_OFFSET_TAB_LEN5[n]	Radius measurement Length measurement
= 0	4. peripheral speed.
= 1	Correction value for 1st radius/length measurement.
= 2	Correction value for 2nd radius/length measurement.
= 3	Correction value for 3rd radius/length measurement.
= 4	Correction value for 4th radius/ length measurement.

SD54700 $SNS_MEA_RESULT_OFFSET_TAB_RAD6[n] SD54710 $SNS_MEA_RESULT_OFFSET_TAB_LEN6[n]	Radius measurement Length measurement
= 0	5. peripheral speed.
= 1	Correction value for 1st radius/length measurement.
= 2	Correction value for 2nd radius/length measurement.

= 3	Correction value for 3rd radius/length measurement.
= 4	Correction value for 4th radius/ length measurement.

20.8.3.4 Measuring workpieces in turning

General settings for turning

MD52740 $MNS_MEA_FUNCTION_MASK	Measuring cycles function mask
Bit 1	Measuring a workpiece: Turning technology - behavior of the 3rd geometry axis (Y)
Bit 16	Tool probe measuring input

Calibration data of the tool probe, referred to the machine coordinate system

Before calibration is started, the position of the tool probe in the machine coordinate system (MCS) must be entered into the following general cycle setting data.

SD54615 $SNS_MEA_CAL_EDGE_BASE_AX1[n]	Calibration slot base referred to the 1st measuring axis.
= 0	

SD54617 $SNS_MEA_CAL_EDGE_PLUS_DIR_AX1[n]	Calibration slot edge in the positive direction of the first measuring axis.
= 0	

SD54618 $SNS_MEA_CAL_EDGE_MINUS_DIR_AX1[n]	Calibration slot edge in the negative direction of the first measuring axis.
= 0	

SD54619 $SNS_MEA_CAL_EDGE_BASE_AX2[n]	Calibration slot base referred to the 2nd measuring axis.
= 0	

SD54620 $SNS_MEA_CAL_EDGE_UPPERE_AX2[n]	Upper calibration slot edge referred to the 2nd measuring axis.
= 0	

SD54621 $SNS_MEA_CAL_EDGE_PLUS_DIR_AX2[n]	Calibration slot edge in the positive direction of the 2nd measuring axis.
= 0	

SD54622 $SNS_MEA_CAL_EDGE_MINUS_DIR_AX2[n]	Calibration slot edge in the negative direction of the 2nd measuring axis.
= 0	

Note

For a standard lathe with axes X and Z (G18), axis Z is the 1st measuring axis and axis X is the 2nd measuring axis.

20.8.3.5 Measuring tools for turning

Calibration data of the tool probe referred to the machine coordinate system

If you wish to calibrate the tool probe in the machine coordinate system, then the position of the tool probe in the machine coordinate system must be entered into the following general cycle setting data.

SD54625 $SNS_MEA_TP_TRIG_MINUS_DIR_AX1[k]	Trigger point in minus direction of the 1st measuring axis (for G18 Z)
= 0	

SD54626 $SNS_MEA_TP_TRIG_PLUS_DIR_AX1[k]	Trigger point in plus direction of the 1st measuring axis (for G18 Z)
= 0	

SD54627 $SNS_MEA_TP_TRIG_MINUS_DIR_AX2[k]	Trigger point in minus direction of the 2nd measuring axis (for G18 X).
= 0	

SD54628 $SNS_MEA_TP_TRIG_PLUS_DIR_AX2[k]	Trigger point in plus direction of the 2nd measuring axis (for G18 X).
= 0	

Index [k] stands for the number of the actual data field (probe number -1).

Calibration data of the tool probe referred to the workpiece coordinate system

If you wish to calibrate the tool probe in the workpiece coordinate system, then the position of the tool probe in the workpiece coordinate system must be entered into the following general cycle setting data. In this case, the reference point is the outer diameter or the tool length of the active tool in the spindle.

Index [k] stands for the number of the actual data field (probe number -1).

SD54640 $SNS_MEA_TPW_TRIG_MINUS_DIR_AX1[k]	Trigger point minus direction of the 1st measuring axis (for G18 Z).
= 0	

SD54641 $SNS_MEA_TPW_TRIG_PLUS_DIR_AX1[k]	Trigger point plus direction of the 1st measuring axis (for G18 Z).
= 0	

SD54642 $SNS_MEA_TPW_TRIG_MINUS_DIR_AX2[k]	Trigger point minus direction of the 2nd measuring axis (for G18 X).
= 0	

SD54643 $SNS_MEA_TPW_TRIG_PLUS_DIR_AX2[k]	Trigger point plus direction of the 2nd measuring axis (for G18 X).
= 0	

Tool measurement using the "Orientable toolholder" or "Swivel tool" function

If the general cycle machine data MD52740 $MNS_MEA_FUNCTION_MASK, bit 16 = 1, then the following setting applies:

MD51618 $MNS_MEA_CM_ROT_AX_POS_TOL	Tolerance parameter for rotary axis settings
= 0.5	Default value

The real angular position of rotary axes can deviate from that programmed (exact stop fine window) This deviation depends on the position control properties of the axis. The maximum deviation that can be expected at a specific axis should be entered into the parameter. When the tolerance is exceeded, Alarm 61442 is output - "Toolholder not parallel to the geometry axes".

20.9 Milling with ShopMill

20.9.1 Setting-up ShopMill cycles for milling

Load ShopMill cycles for milling

When the control boots, the ShopMill cycles are automatically loaded into the following directory: ../siemens/sinumerik/cycles/sm/prog

Setting the coordinate system

MD52000 $MCS_DISP_COORDINATE_SYSTEM	Position of the coordinate system
= 0	

Examples:

=0 for vertical milling machines

=16 for horizontal milling machines, boring mill

A detailed description of the MD52000 is provided in Section:

Activating turning/milling/drilling technologies (Page 385)

For plane selection when milling, appropriately set the following machine data:

MD52005 $MCS_DISP_PLANE_MILL	Plane selection for milling
= 17	
= 0	In the cycle support
= 17	G17 (default value)
= 18	G18
= 19	G19

Simulation and simultaneous recording

In order that simulation and simultaneous recording are displayed without any errors, set the machine data as described in the following section:

Configuring the simulation (Page 96)

Defining the direction of rotation

In order that the direction of rotation is correctly displayed in the ShopMill user interface, and when programming ShopMill functions, the correct direction of rotation is executed, you must make some settings that are coordinated with one another. You must align these settings to the actual direction of rotation of the axis at the machine.

MD52207 $MCS_USAGE_ATTRIB[n]	Attribute of the axes in the channel [n] channel axis number
Bit 4	Displayed direction of rotation for M3 is counter-clockwise (for spindles)
Bit 5	Direction of rotation M3 corresponds to rotary axis minus (for spindles) This bit must be set analog to PLC bit DBnn.DBX17.6!

Additional channel-specific machine data

MD52229 $MCS_ENABLE_QUICK_M_CODES	Enable fast M commands
= 0	
Bit 0	Coolant OFF (default value)
Bit 1	Coolant 1 ON
Bit 2	Coolant 2 ON
Bit 3	Coolants 1 and 2 ON

MD52230 $MCS_M_CODE_ALL_COOLANTS_OFF	M code for all coolants Off
= 9	You define the M function to switch off the coolant that is output when the tool is changed.

MD52231 $MCS_M_CODE_COOLANT_1_ON	M code for coolant 1 On
= 8	You define the M function for coolant 1 that is output when the tool is changed.

MD52232 $MCS_M_CODE_COOLANT_2_ON	M code for coolant 2 On
= 7	You define the M function for coolant 2 that is output when the tool is changed.

MD52233 $MCS_M_CODE_COOLANT_1_AND_2_ON	M code for both coolants On
= -1	You define the M function for coolant 1 and 2 that is output when the tool is changed.

MD52281 $MCS_TOOL_MCODE_FUNC_ON[ ]	M code for tool-specific function ON
= -1	M function is not output. If both M commands of a function "= -1", the corresponding field is not displayed on the interface.
[0]	M code for tool-specific function 1 ON

[1]	M code for tool-specific function 2 ON
[2]	M code for tool-specific function 3 ON
[3]	M code for tool-specific function 4 ON

MD52282 $MCS_TOOL_MCODE_FUNC_OFF[ ]	M code for tool-specific function OFF
= -1	M function is output. If both M commands of a function "= -1", the corresponding field is displayed on the interface.
[0]	M code for tool-specific function 1 OFF
[1]	M code for tool-specific function 2 OFF
[2]	M code for tool-specific function 3 OFF
[3]	M code for tool-specific function 4 OFF

Channel-specific cycle setting data

SD55212 $SCS_FUNCTION_MASK_TECH_SET	Cross-technology function screen
= 6	
Bit 0	Tool preselection active. The next tool is prepared directly after a tool change. Note: For a revolver, the setting data must be set to "0".
Bit 1	Automatic calculation of the thread depth for metric threads.
Bit 2	Take the thread diameter and thread depth from the table.

20.9.2 Cylinder surface transformation in ShopMill

Software options

You require the following software option in order to use this function:
"Transmit and peripheral surface transformation".

Precondition

- There must be at least one rotary axis at the machine.
- The milling tool must be radially oriented to the cylinder to be machined.

Function

The following groove machining operations can be performed with the Cylinder surface transformation functions:

- Longitudinal grooves on cylindrical bodies
- Transverse grooves on cylindrical objects
- Grooves with any path on cylindrical bodies

The path of the slots is programmed with reference to the flattened,plane cylinder surface. The programming can be performed using straight line / circle, drilling or milling cycles or contour milling (free contour programming).

Setting up

In addition, set the following channel-specific configuration machine data in ShopMill:

MD52214 $MCS_FUNCTION_MASK_MILL		ShopMill function screen
= 1H		
Bit 0	Enable cylinder surface transformation for milling in ShopMill	

20.9.3 ShopMill cycles for multiple clamping

Software options

You require the following software option in order to use this function:
"ShopMill/ShopTurn"

Function

The Multiple clamping function provides optimized tool change over several workpiece clampings. On the one hand, this reduces downtimes and, on the other, eliminates tool change times because a tool performs as many machining operations as possible in all clampings before the next tool change is initiated.

You can either execute the same program several times for the clampings or you can select different programs. If you are using large-area fixture plates on your machine, you do not have to set up anything else.

In the case of rotating clamping devices, on the other hand, you must adapt a cycle to match the features of the clamping device so as to ensure that the next workpiece can be turned to the machining position after machining of the previous one (or for multiple clamping devices even while the current workpiece is being machined).

Procedure for setting up

1. Change the CLAMP.SPF cycle which is stored in the cycle/sc/prog/templates_deu or cycle/sc/prog/templates_eng directory.
2. Copy the cycle into the user or manufacturer directory.

Example

A rotating clamping device (reversible clamping device) is used with four clampings. The respective clampings can be machined by positioning rotary axis A:

Clamping 1:	A = 0°
Clamping 2:	A = 90°
Clamping 3:	A = 180°
Clamping 4:	A = 270°

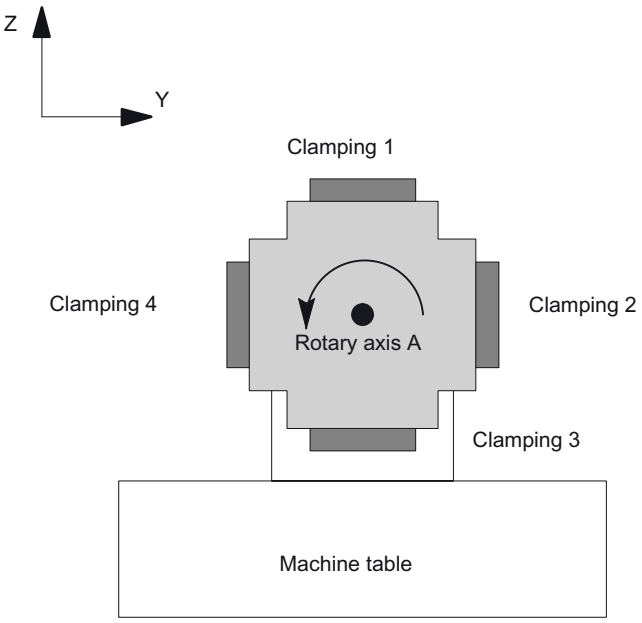


Figure 20-10 Rotating clamping device (reversible clamping device)

The cycle CLAMP.SPF must be adapted as follows:

```
...
DEF INT _NV ; Auxiliary variable
;-------------------------------------
;Adaptation
;
IF _ACT==1
G0 A=DC(0)
```

```
ENDIF
;
IF _ACT==2
G0 A=DC(90)
ENDIF
;
IF _ACT==3
G0 A=DC(180)
ENDIF
;
IF _ACT==4
G0 A=DC(270)
ENDIF
;
;-------------------------------------
_NV=_NPV+_ACT ; Calculate current zero offset
N10 G[8]=_NV ; There must not be a calculation here
RET
```

20.10 Turning with ShopTurn

20.10.1 Setting-up ShopTurn cycles for turning

MD52210 $MCS_FUNCTION_MASK_DISP	Function mask display
Bit 0 = 1	Dimension system for programs always in the basic system (default setting)
Bit 1 = 1	Face view when turning (default setting)
Bit 4 = 1	Display follow-on tool in the T,F,S window

MD52214 $MCS_FUNCTION_MASK_MILL	Milling function screen
Bit 3	"Inner/rear" machining is enabled in the ShopTurn screens which themselves define the machining plane.
Bit 4	If you have implemented the "Clamp/release spindle" function using the manufacturer cycle CUST_TECHCYC.SPF, then using this machine data, you can activate the "Clamp/release spindle" parameter in the drilling and milling screens.
= 0	The "Clamp/release spindle" parameter is not displayed in the drilling and milling screens. ShopTurn automatically clamps the spindle if it makes sense for the particular machining operation.
= 1	The "Clamp/release spindle" parameter is displayed in the drilling and milling screens. You decide for which machining operation the spindle should be clamped.

MD52218 $MCS_FUNCTION_MASK_TURN	Turning function screen
Bit 2	Enable tailstock
Bit 5	Enable spindle control of tool spindle via user interface
Bit 6	Enable Balance Cutting for two-channel stock removal

MD52229 $MCS_ENABLE_QUICK_M_CODES	Enable quick M commands
= 0	
Bit 0	Coolant OFF
Bit 1	Coolant 1 ON
Bit 2	Coolant 2 ON
Bit 3	Coolants 1 and 2 ON

MD52230 $MCS_M_CODE_ALL_COOLANTS_OFF	M code for all coolants off
= 9	This machine data is used to define the M function for switching off the coolant; which is output when the tool is changed.

MD52231 $MCS_M_CODE_COOLANT_1_ON	M code for coolant 1 on
= 8	This machine data is used to define the M function for coolant 1, which is output when the tool is changed.

MD52232 $MCS_M_CODE_COOLANT_2_ON	M code for coolant 2 on
= 7	This machine data is used to define the M function for coolant 2, which is output when the tool is changed.

MD52233 $MCS_M_CODE_COOLANT_1_AND_2_ON	M code for both coolants on
= -1	This machine data is used to define the M function for coolant 1 and 2, which is output when the tool is changed.

20.10.2 Setting up the counterspindle under ShopTurn

Software option

You require the following software options in order to use the counterspindle on your machine:

- "Travel to fixed stop with Force Control"
- "Synchronous spindle/multi-edge turning"

The position to which the counterspindle travels when the program starts is defined in the following channel-specific cycle setting data:

SD55232 $SCS_SUB_SPINDLE_REL_POS	Retraction position Z for counterspindle

The following channel-specific setting data become effective when traveling to the fixed stop:

SD55550 $SCS_TURN_FIXED_STOP_DIST	Distance for travel to fixed stop.
SD55551 $SCS_TURN_FIXED_STOP_FEED	Feedrate for travel to fixed stop.
SD55552 $SCS_TURN_FIXED_STOP_FORCE	Force for travel to fixed stop in %.

Between traveling to the fixed stop and gripping, the counterspindle can retract a short distance to counteract compressive stress in the workpiece.

SD55553 $SCS_TURN_FIXED_STOP_RETRACTION	Retraction distance before clamping after fixed stop.

After gripping you can cut off the workpiece. Before doing so, the counterspindle can retract a short distance with the workpiece to exert tensile stress on the workpiece. This relieves pressure on the tool when cutting off.

SD55543 $SCS_TURN_PART_OFF_RETRACTION	Retraction distance before cut-off.

After parting, you can carry out a cut-off check and for turning, use the "Travel to fixed stop" function. You can activate/deactivate the cut-off check using the channel-specific cycle setting data:

SD55540 $SCS_TURN_PART_OFF_CTRL_DIST	Distance for cut-off check.
SD55541 $SCS_TURN_PART_OFF_CTRL_FEED	Feedrate for cut-off check.
SD55542 $SCS_TURN_PART_OFF_CTRL_FORCE	Force for cut-off check in %.

The cut-off is successful when travel to fixed stop fails. The following alarms are output:

Alarm	Alarm text
20091	Axis %1 has not reached the fixed stop.
20094	Axis %1 end stop has been aborted.

You can switch off the alarm display using the following machine data:

MD37050 $MA_FIXED_STOP_ALARM_MASK	Enabling the fixed stop alarms.
= 2	Suppressing alarms 20091 and 20094.

You can set this machine data axis-specifically in the "Machine Data" window in the "Tool zero" operating area.

If, however, the specified force is reached during the cut-off check (i.e. travel to fixed stop is successful), alarm 61255 "Error during cut-off: Tool break?" is issued.

Note

The "Travel to fixed stop" function can also be used when gripping the spindle (see above). If travel to fixed stop does not succeed when gripping, an alarm will of course also be issued. Instead of alarms 20091 and 20094, the alarm 61254 "Error during travel to fixed stop" will be issued.

Machine manufacturer cycle

If you perform one of the following actions, you must adapt the machine manufacturer cycle CUST_TECHCYC.SPF.

- Switch between spindle and C axis mode for the main spindle or counterspindle.
- Open, close, flush chuck (main spindle / counterspindle).
- Change default settings for the coupling of the main spindle and counterspindle.

Please refer to the following section for the procedure:

Setting-up ShopTurn cycles for turning (Page 503)

20.10.3 Drilling centered under ShopTurn

Precondition

If the technology screens are hidden using the channel-specific configuration machine data MD52216 $MCS_FUNCTION_MASK_DRILL, then the settings in the following channel-specific cycle setting data are effective.

Tapping centered (CYCLE84)

SD55481 $SCS_DRILL_TAPPING_SET_GG12[1]	Exact stop response
= 0	Exact stop response as before the cycle call (default value).
= 1	G601
= 2	G602
= 3	G603

SD55482 $SCS_DRILL_TAPPING_SET_GG21[1]	Acceleration behavior
= 0	Acceleration behavior as before the cycle call (default value).
= 1	SOFT
= 2	BRISK
= 3	DRIVE

SD55483 $SCS_DRILL_TAPPING_SET_GG24[1]	Feedforward control
= 0	Precontrol, the same as before the cycle call (default value).
= 1	FFWON
= 2	FFWOF

20.10.4 Cylinder surface transformation (TRACYL) under ShopTurn

Software option

You require the following software option in order to use this function:

"Transmit and peripheral surface transformation"

Function

If you wish to use the function cylinder surface transformation (TRACYL) under ShopTurn, please take the settings from Chapter:

Cylinder surface transformation (TRACYL) (Page 397)

Setting up

In addition, set the following channel-specific configuration machine data:

MD52214 $MCS_FUNCTION_MASK_MILL	Milling function masks (screens).
Bit 3	Enable "internal / rear" machining in ShopTurn masks (screens) that define the machining plane themselves.
Bit 4	If you have implemented the "Clamp/release spindle" function using the machine manufacturer cycle CUST_TECHCYC.SPF, then using this machine data, you can activate the "Clamp/release spindle" parameter in the drilling and milling screens.
= 0	The "Clamp/release spindle" parameter is not displayed in the drilling and milling screens. ShopTurn automatically clamps the spindle if it makes sense for the particular machining operation.
= 1	The "Clamp/release spindle" parameter is displayed in the drilling and milling screens. The operator decides for which machining operation the spindle should be clamped.

References

Additional information on cylinder surface transformation is provided in:

840D sl Programming Manual Job Planning: Cylinder surface transformation

20.10.5 Face end machining (TRANSMIT) under ShopTurn

Software option

You require the following software option in order to use this function:

"Transmit and peripheral surface transformation"

Function

If you wish to use the end face machining function under ShopTurn, please proceed as described in Chapter End face machining (TRANSMIT) (Page 417).

Setting up

In addition, set the following channel-specific configuration machine data:

MD52214 $MCS_FUNCTION_MASK_MILL	Function screens, ShopTurn.
Bit 3	Enable "internal / rear" machining in ShopTurn masks (screens) that define the machining plane themselves.
Bit 4	If you have implemented the "Clamp/release spindle" function using the machine manufacturer cycle CUST_TECHCYC.SPF, then using this machine data, you can activate the "Clamp/release spindle" parameter in the drilling and milling screens.
= 0	The "Clamp/release spindle" parameter is not displayed in the drilling and milling screens. ShopTurn automatically clamps the spindle if it makes sense for the particular machining operation.
= 1	The "Clamp/release spindle" parameter is displayed in the drilling and milling screens. The operator decides for which machining operation the spindle should be clamped.

Note

The face end machining is automatically integrated in the cycles, with the exception of the straight line and circle.

You can select the functions for these two cycles in the "Program" operating area at "Straight line" and "Circle".

References

Additional information on face end machining is provided in:

Function Manual, Extended Functions; Kinematic Transformation (M1): TRANSMIT

20.10.6 Inclined Y axis (TRAANG) under ShopTurn

Software option

You require the following software option in order to use the inclined Y axis function on your machine:

"Inclined axis"

Function

If you wish to use the inclined Y axis function under ShopTurn, please first make the settings from Chapter Inclined Y axis (TRAANG) (Page 420).

Note

Once the inclined axis function has been set up in the user interface, it is automatically integrated in the cycles. This means that for machining with inclined axis, you can select "Face Y" or "Surface Y" in the machining plane screens and enter Cartesian coordinates.

References

You will find additional information on the inclined Y axis function in:

840D sl Programming Manual Job Planning: Inclined axis (TRAANG)

Additional language 21

21.1 Installing additional languages

Additional languages

In addition to the already existing standard languages, additional user interface languages are available on a separate DVD.

The integrated online help is either displayed in the relevant language of the country or in English.

Refer to the following chapter for the languages that are available for the user interface: Supported languages (Page 513)

Precondition

- After the installation, approx. 256 MB memory must be available on the CompactFlash Card.
- Language extension software "hmi_sl_language_xxx_02.06.00.00.00y.tgz".
  xxx = language code, y = internal version ID
  Is supplied on the language extension DVD.

Installing a language

Two options of how you can install a language are subsequently described:

1. Via USB FlashDrive
2. Via PC with WinSCP

Installing a language via USB FlashDrive

1. Copy the language extension software "hmi_sl_language_xxx_02.06.00.00.00y.tgz" from the DVD under Windows to the main directory (root) of a USB FlashDrive.
2. Insert the USB FlashDrive (with installed NC service system) into the NCU that is switched-off.

3. Switch-on the NCU.
   The service menu is displayed.
4. Select "5/F5: Update NCU Software and Data".
   - Select "1/F1: Update System Software from USB memory stick".
     The data are displayed on the USB FlashDrive.
   - Select "1/F1: Update System software by selected file" and select the required language extension software "hmi_sl_language_xxx_02.06.00.00.00y.tgz".
   - Select "8/F8: ok, continue".
     The data are unzipped and loaded.

- OR -

1. Select "8/F8: Service Shell".
   - Log on as user "manufact". Ensure that the user name and the login are written in lower-case letters and, if required, use an external keyboard.
   - After the prompt "$" enter the command "cd /data" and press the return key.
   - Enter "ls".
     The files are displayed.
   - Now enter the following:
     "sc restore -update /hmi_sl_language_xxx_02.06.00.00.00y.tgz"
     Press the Return key.
     The language extension data are unzipped and when successfully completed, you obtain a message.
2. Switch-off the NCU off.
3. Withdraw the USB FlashDrive.
4. Restart the NCU.

Installing a language via PC with WinSCP

1. Insert the language extension DVD in the PC.
   If there is no connection to the DVD drive from the "WinSCP" program, copy the required data ".tgz" into a temporary directory of the PC.
2. Open the "WinSCP" program. Select the PC directory and on the CompactFlash Card, the directory /card/user/system/home/manufact.
3. Drag the language extension software "hmi_sl_language_xxx_02.06.00.00.00y.tgz" from the DVD or from the temporary directory and drop in the directory of the CompactFlash Card.
4. Open the "Input prompts" window via the tab "Commands", "Open terminal".
5. Enter the following command: "sc restore -update -force"
6. Press the "Execute" button. The language extension is installed.
7. Press the "Close" button after you have obtained the message that the operation was successfully completed.
8. Delete the language extension software "hmi_sl_language_xxx_02.06.00.00.00y.tgz" from the directory of the CompactFlash Card in order to save memory space.

9. Exit the "WinSCP" program.
10. Switch-off the NCU off.
11. Restart the NCU.

Note

If the installed language is not visible after switching-off and switching-on the first time, completely switch-off the NCU again and switch-on again.

21.2 Supported languages

Table 21- 1 Supported languages

Language	Language code	Standard languages
Chinese (simplified)	chs	X
Chinese (traditional)	cht	
Danish	dan	
German	deu	X
English	eng	X
Finnish	fin	
French	fra	X
Italian	ita	X
Japanese	jpn	
Korean	kor	
Dutch	nld	
Polish	plk	
Portuguese	ptb	
Romanian	rom	
Russian	rus	
Swedish	sve	
Slovakian	sky	
Spanish	esp	X
Czech	csy	
Turkish	trk	
Hungarian	hun	

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22.1 Link OEMFrame application

Integrating an OEM application

The following files should be adapted and created in order to integrate an OEMFrame application into the operating software:

- Configuration file systemconfiguration.ini

  The operating software is started and controlled from the system manager; the system manager also controls the OEMFrame applications. The system manager is configured using the "systemconfiguration.ini" configuration file.

- Configuring the start softkey

  In order to start an OEMFrame application from the operating software, configure a softkey on the expansion bar of the operating area.

- Configuration file "slamconfig.ini"

  In order to configure the softkey position with text and/or symbol for the OEMFrame application, generate the "slamconfig.ini" file.

- Save the language-dependent text for a softkey in the file mytext_<lng>.ts.

"systemconfiguration.ini" file

In order to integrate an OEMFrame application into the operating software, copy the "systemconfiguration.ini" configuration file and place it in one of the two directories:

<Installation path>/**user**/sinumerik/hmi/cfg

<Installation path>/**oem**/sinumerik/hmi/cfg

All of the processes to be managed by the system manager, as well as the applications that are to be integrated as OEMFrame applications are in the **[processes]** section.

Value	Meaning
process	Symbolic name of the OEMFrame application. This is required to configure the operating areas.
cmdline	Command line which is transferred to the "oemframe.exe" process when starting.
oemframe	For OEMFrame applications, always set to "true".
windowname	Window name of the OEMFrame application - should be determined with "findwindow.exe" or "spy++.exe".

Value	Meaning
classname	Class name of the OEMFrame application - should be determined with "findwindow.exe" or "spy++.exe".
deferred	true: OEMFrame application is not started when SINUMERIK Operate powers up, but only when selected for the first time.

Example

In the following example, the two Windows applications "notepad.exe" and "calc.exe" are configured as OEMFrame applications.

```
[processes]

PROC600= process:=notepadOEM,cmdline:="notepad.exe mytext1.txt", oemframe:=true,
deferred:=true, windowname:="mytext1.txt - Notepad", classname:="Notepad"

PROC601= process:=calcOEM, cmdline:="calc.exe" oemframe:=true,
windowname:="calculator"
```

Section **[areas]**

The SINUMERIK Operate operating areas are configured in this section.

Value	Meaning
name	Symbolic name for the operating area.
process	Name of the OEMFrame application according to section [processes].

Note

Permissible number range

In the "processes" and "areas" sections, the number range 500-999 is reserved for OEM customers. If you use numbers less than 500, then it is possible that Siemens basis components will be overwritten!

Example

```
[areas]

AREA600= name:=AreaOEM, process:=notepadOEM

AREA601= name:=AreaCalc, process:=calcOEM
```

Note

Only OEMFrame applications are supported that do not use any of the programming interfaces of SINUMERIK Operate.

Section **[miscellaneous]**

You can make various settings in this section. Generally, only the start operating area is changed.

Key	Value
startuparea	Name of the start operating area

Example

```
[miscellaneous]

startuparea = AreaOEM
```

Configuring the operating area menu

The operating area menu is intended for switching over the operating areas configured in the "systemconfiguration.ini" configuration file. A softkey for selecting the appropriate operating area is provided on the horizontal softkey bar for each operating area configured.

The operating area displays the names of the operating areas from the "systemconfiguration.ini" configuration file as the text on the operating area softkeys. The system automatically searches for a free softkey on the horizontal softkey bar for each operating area.

Configuring additional settings

In order to configure the following settings you require the "slamconfig.ini" configuration file:

- Assigning a softkey position to a specific operating area.
- Creating a language-dependent text for the softkey.
- Displaying a symbol for the operating area on the softkey.

Creating the "slamconfig.ini" configuration file

Copy the "slamconfig.ini" and place the file in the same directory in which the "systemconfiguration.ini" file is located:

<Installation path>/**user**/sinumerik/hmi/cfg

<Installation path>/**oem**/sinumerik/hmi/cfg

"slamconfig.ini" file

In the "slamconfig.ini" configuration file, for every operating area, you can create a section that was configured in the "systemconfiguration.ini" file. The section must bear the configured name of the appropriate operating area, e.g. AreaOEM.

Value	Meaning
TextId	Text ID for a foreign-language text which will be displayed as the softkey label.
TextContext	Context of the foreign-language text.
TextFile	Name of the text file which includes the context and the foreign-language text.
Graphic	Name of an image file which will be used as an icon for the softkey.
SoftkeyPosition	Fixed softkey position of the area softkey. In this case, softkey positions 1 to 8 are located on the 1st horizontal bar and softkey positions 9 to 16 on the 2nd horizontal bar, etc.
AccessLevel	Access level from which the softkey will be displayed. If this value is not specified, the access level 7 (keyswitch position 0) is set.

Example

The softkey for the "AreaOEM" operating area with the following properties is configured in the following example:

- The softkey displays the text which has been stored in the "mytext_<lng>.ts" text file under the context "mycontext" with the "MY_AREA" TextID.
- The "mypicture.png" icon is displayed on the softkey.
- The softkey is located at position 7 in the operating area menu.
- The softkey with access level 5 (keyswitch position 2) is displayed.

```
[AreaOEM]

; Text-ID of a language dependent text

TextId = MY_AREA

; File name of the text file which contains the Text-ID

TextFile = mytext

; Context in the text file to which the Text-ID is assigned to

TextContext = mycontext

; File name of an icon shown on the area softkey

Picture = mypicture.png

; Position of the area softkey on area menu,

; If no position is specified, an empty position is searched

SoftkeyPosition = 7

; Access level of the area softkey

AccessLevel = 5
```

Note

Operating area position 7 is reserved for OEM customers.

Labeling text for the softkey

Storage path:

<Installation path>/**user**/sinumerik/hmi/lng

<Installation path>/**oem**/sinumerik/hmi/lng

The XML identifiers have the following meanings:

Attribute	Description
context	Context within the text file. Each file must have at least one context.
name	Name of the context.
message	Text translation. There must be at least one message per context.
source	Text identifier.
translation	Translated text.
remark	Text comment (optional).
chars	Maximum possible length of the text in characters. If nothing is specified, the text can have any length (optional).
lines	Maximum number of lines available for display. If nothing is specified, the number of lines is unlimited (optional).

Structure of the language-dependent ts file that contains the labeling text for the softkey:

mytext_<lng>.ts

```
<?xml version="1.0" encoding="utf-8" standalone="yes"?>
<!DOCTYPE TS>
<TS>
  <context>
  <name>mycontext</name>
    <message>
      <source>MY_AREA</source>
        <translation>Text, which is displayed on the softkey</translation>
        <remark>Remark (optional)</remark>
        <chars>20</chars>
        <lines>2</lines>
    </message>
  </context>
```

```
 mytext <lng>.ts
</TS>
```

<lng> stands for the language code.

22.2 Setting the IP address of the NCU

From the user interface of the SINUMERIK Operate, you can set the IP address of the NCU with which it should connect.

Procedure

1. Select the "Start-up" operating area.

2. Press the "HMI" softkey and the ">>" softkey.

Press the vertical softkey "NCU connection".
The "NCU Connection" window opens.
Enter the IP address of the NCU into the input field.

3. Press the "OK" softkey to confirm the data.

22.3 SINUMERIK Operate exiting

Procedure

1. Press the <MENU SELECT> key on the operator panel.
   OR:
   Activate the <M> symbol on the touch panel.

   External keyboard: Press the <F10> key.

2. Press the menu forward key.
   External keyboard: Press the <Shift> + <F9> keys.

3. Press the "EXIT" softkey.
   External keyboard: Press <F8>
   - on the PCU to terminate SINUMERIK Operate and the Windows system.
   - If you started SINUMERIK Operate operating software on the PCU in the service mode, then only the operating software is exited.
   - On the PC itself, only SINUMERIK Operate is exited.

HT 8

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23.1 Activating/deactivating the virtual keyboard

The virtual keyboard is configured in the file "slguiconfig.ini".

Procedure

1. Copy the "slguiconfig.ini" file from the folder /**siemens**/sinumerik/hmi/template/cfg.
2. Paste the copy of the file into the following directory: /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg.
3. Open the file in the editor.
4. To activate or deactivate the keyboard, make the following settings:
   - Activating the virtual keyboard:
     In the section [TouchPanel], EnableTouch = true
     In the section [Keyboard], EnableVirtualKeyBoard = true
   - Deactivating the virtual keyboard:
     In the section [TouchPanel], EnableTouch = true
     In the section [Keyboard], EnableVirtualKeyBoard = false
5. Double click in the input field to display the keyboard.

23.2 Configuring the traversing keys

The traversing keys of the HT 8 are not labeled as their type of action is not predefined. The labeling of the traversing keys should adapt dynamically to the type of action of the keys. To recognize the type of action of the traversing keys, they are shown within the display in the vertical softkey area.

The menu of the traversing keys consists of two vertical rows each with eight keys so that up to 16 texts can be configured. The top and bottom traversing key row remain empty and can be assigned other functions.

The following data can be displayed:

- Machine axis name
- Alias name for machine axis
- Any language-dependent text
- Symbol

The following user-specific files are required. You can use the sample files as template:

File	Meaning
"sljkconfig.ini" configuration file	File in which the traversing keys are configured.
Text file "oem_sljk_xxx.ts"	File for labeling traversing keys in a foreign language, xxx = language code

"sljkconfig.ini" configuration file

Entries	Meaning	
[State_1]	Labeling type - changed via the PLC.	
ParamText_x_y	Text of the traversing key that is made up of parameters. Two-line labeling is possible, whereby max. five characters are possible per line. x: Specifies the position of the key within the row (2 to 7). y: Specifies the key row (1 or 2).	
	%m1	The machine axis name of the first axis is referenced and displayed as text. The current active axis number is read out from data block DB10. The name from the machine data is determined via this index.
	%n	Defines the position in the text for the line break.
	%a1	The alias axis name of the first axis is referenced and displayed as text. The current active axis number is read out from data block DB10. The name from the "oem_sljk_eng.ts" text file is determined via this index.
TextId_x_y	Text of the traversing key that is read from the text file (target language text).	
Picture_x_y	File name of the icon to be displayed. The files with the icons must be located in the following directories: /**oem**/sinumerik/hmi/ico and depending on the resolution of the subdirectories: /ico640 /ico800 /ico1024 /ico1280	

Procedure

1. Copy the "sljkconfig.ini" configuration file from the folder /**siemens**/sinumerik/hmi/template/cfg
2. Place the copy into the folder /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg
3. Open the copy in the Editor and define the traversing key labeling.

Example of a "sljkconfig.ini" configuration file

12 axes are defined in the example, with text for softkey 1 and softkey 2, as well as an image on softkey 3 and softkey 4.

```
[Settings]

FileType = INI


; A few examples for further configuration options

; Alias names of machine-axes (%a1, %a2, etc.), from oem_sljk_deu.ts (example)


[State_1]

TextId_1_1 = OEM_JK_TEXT_1

TextId_1_2 = OEM_JK_TEXT_2

ParamText_2_1 = %a1%n-

ParamText_2_2 = %a1%n+

ParamText_3_1 = %a2%n-

ParamText_3_2 = %a2%n+

ParamText_4_1 = %a3%n-

ParamText_4_2 = %a3%n+

ParamText_5_1 = %a4%n-

ParamText_5_2 = %a4%n+

ParamText_6_1 = %a5%n-

ParamText_6_2 = %a5%n+

ParamText_7_1 = %a6%n-

ParamText_7_2 = %a6%n+

Picture_8_1 = AlarmCancel.png

Picture_8_2 = AlarmNCReset.png
```

"oem_sljk_eng.ts" text file

Entries	Meaning
name	Freely selectable name of the text context. In the text file template, the name of the text context is "SIJkLabels" and stands for the traversing key labeling (solution line jog key labels). This identifier is already stored in the configuration file.
source	Traversing key identifier of the respective axis. This text ID is referenced in the "sljkconfig.ini" configuration file with the "TextId_2_1". The text IDs for the alias names (JK_AXISNAME_2 to JK_AXISNAME_7) must not be changed.
translation	Input of the foreign language text for the axis specified in <source>.

Language code in file names "xxx"

Language	Language code
German	deu
English	eng
French	fra
Spanish	esp
Italian	ita
Chinese	chs

Procedure

1. You can copy the sample file " oem_sljk_deu.ts" from the following directory: /**siemens**/sinumerik/hmi/template/lng.
2. Store or create the file in the /**oem**/sinumerik/hmi/lng or /**user**/sinumerik/hmi/lng directory.
3. Give the file a name, e.g. for German texts: "sljk_deu.ts".
   If you wish to set-up the labeling for additional languages, a separate file must be created for each language. Save the file with the appropriate language code in the file name. To do this, use the language codes specified above.
4. Open the file and in the <message> and </message> area, define the labeling.
5. Restart the HMI.
   In order that the labeling is displayed during the program runtime, the file must be converted into a binary format. This conversion is only executed when the HMI powers up.

Example of a text file "sljk_deu.ts"

12 axes are defined in the example, with text for softkey 1 (SF1) and softkey 2 (SF2):

```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE TS>
<TS>
      <context>
          <name>SlJkLabels</name>
          <!-- Alias names for machine axis (%a1, %a2, etc.) -->
          <!-- Do not change the text ID (JK_AXISNAME_1, etc.) -->
          <message>
                <source>JK_AXISNAME_1</source>
                <translation>X</translation>
          </message>
          <message>
                <source>JK_AXISNAME_2</source>
                <translation>Y</translation>
          </message>
          <message>
                <source>JK_AXISNAME_3</source>
                <translation>Z</translation>
          </message>
          <message>
                <source>JK_AXISNAME_4</source>
                <translation>A</translation>
          </message>
          <message>
                <source>JK_AXISNAME_5</source>
                <translation>B</translation>
          </message>
          <message>
                <source>JK_AXISNAME_6</source>
                <translation>C</translation>
          </message>
          <message>
                <source>JK_AXISNAME_7</source>
                <translation>U</translation>
          </message>
          <message>
                <source>JK_AXISNAME_8</source>
                <translation>V</translation>
          </message>
          <message>
                <source>JK_AXISNAME_9</source>
```

```
            <translation>W</translation>
        </message>
        <message>
            <source>JK_AXISNAME_10</source>
            <translation>UV1</translation>
        </message>
        <message>
            <source>JK_AXISNAME_11</source>
            <translation>UV2</translation>
        </message>
        <message>
            <source>JK_AXISNAME_12</source>
            <translation>UV3</translation>
        </message>
        <!-- User defined language dependent text (example) -->
        <message>
            <source>OEM_JK_TEXT_1</source>
            <translation>SF1</translation>
        </message>
        <message>
            <source>OEM_JK_TEXT_2</source>
            <translation>SF2</translation>
        </message>
</TS>
```

See also

Supported languages (Page 513)

23.3 Configuring user-specific key labeling

Labeling the keys for the HT 8

The texts of the CPF menu (CPF: Control Panel Function) for the HT 8 can be labeled with your own texts in the particular language of the country.

The texts are created in the "slck_xxx.ts" file.
"xxx" = language code for the corresponding language-specific labeling.

You can create and edit this file using the HMI or also externally on a PC.

Note

If you wish to create or edit the file on a PC, use an editor that supports UTF-8 coding.

Language code in file names "xxx"

Language	Language code
German	deu
English	eng
French	fra
Spanish	esp
Italian	ita
Chinese	chs

Creating key labeling

Tag	Meaning
source	Designation for the user softkey. "SK_USERKEY1" to "SK_USERKEY16" are possible, whereby the names may not be changed.
comment	User-specific description of the key assignment.
translation	Text that should be shown on the key. • A maximum of 10 characters are possible per line. • 2-line labeling is possible, whereby the line break is set using "%n".
remark	Remark for key assignment.
chars	Number of characters. A maximum of 10 characters per line are possible.
lines	Number of lines. 2 lines are possible.

Procedure

1. You can copy the sample file " oem_slck_deu.ts" from the following directory: /**siemens**/sinumerik/hmi/template/lng.
2. Store or create the file in the /**oem**/sinumerik/hmi/lng or /**user**/sinumerik/hmi/lng directory.
3. Give the file a name, e.g. for German texts: "slck_deu.ts".
   If you wish to create the key labeling for additional languages, then a separate file must be created for each language. Save the file with the appropriate language code in the file name. To do this, use the language codes specified above.
4. Open the file and in the <message> and </message> area, define the key labeling.
5. Restart the HMI.
   In order that the key labeling is displayed during the program runtime, the file must be converted into a binary format. This conversion is only executed when the HMI powers up.

Example of a key label

```
<!DOCTYPE TS><TS>
<context>
   <name>SlCkDialog</name
   <message>
     <source>SK_USERKEY1</source>
     <comment></comment>
     <translation>U1</translation>
     <remark>User key 1</remark>
     <chars>10</chars>
     <lines>2</lines>
     <languageIndependent>true</languageIndependent>
   </message>
   <message>
     <source>SK_USERKEY2</source>
     <comment></comment>
     <translation>U2</translation>
     <remark>User key 2</remark>
     <chars>10</chars>
     <lines>2</lines>
     <languageIndependent>true</languageIndependent>
   </message>
   <message>
   .....
   </message>
</context>
</TS>
```

See also

Range of alarms (Page 204)

23.4 Configuring the function display at user-specific keys (U keys)

Function

Active functions can be displayed at the configurable user keys via the PLC. For instance, small LEDs can be emulated on the softkeys.

You configure the function in the "slckcpf.ini" file.

Interface signals

The PLC bits are in the output image of the PLC-HT 8 interface and are analog to those in the input image.

Signals to the MCP1 (or MCP2) Interface PLC → HT 8								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
AB n + 1		U4	U3		U2	U1		
AB n + 4	U9	U10	U11	U12	U13	U14	U15	U16
AB n + 5		U8	U7	U6	U5			

Adapt the display in the "slckcpf.ini" file

Section	Description	
`UserKeyLEDIcon`	Name of the icon file. Standard entry: `led_green.png`	
	`OFF`	Deactivates the icon display.
	`PRESSED`	Displays the active functions by pressing down the softkey.
`UserKeyLEDIconAlignment`	Specifies the position of the icon. Standard position: `AlignLeft | AlignTop` Horizontal and vertical alignments can be combined. The two names are separated by the `"|"` character. The following alignments are possible:	
	`AlignLeft`	Left
	`AlignRight`	Right
	`AlignHCenter`	Horizontal, center
	`AlignTop`	Top
	`AlignBottom`	Bottom

Section	Description	
	AlignVCenter	Vertical, center
UserKeyLEDMap	Specifies the start address of the output image. Entries can be made in the following form: "DBx.DBBy", "ABx", "MBx". Default setting: The start address is determined using DB7 MCP1Out (or MCP2Out).	
U1LED ... U16LED VarIncLED SBLLED WCSLED	The status bit address can be defined - different from the output image - using these entries. Note: The offsets from the HT 8 output image, for one or several softkeys, are not taken into consideration.	
showVarIncLED	true	When the increment mode is active, the icon is also displayed on the "[VAR]" softkey.
	false	The icon is not displayed.
showSBLLED	true	When the SingleBlock mode is active, then the icon is also displayed on the "Single Block" softkey.
	false	The icon is not displayed.
showWCSLED	true	When the SingleBlock mode is active, then the icon is also displayed on the "Single Block" softkey.
	false	The icon is not displayed.

1. You can copy the sample file "slckcpf.ini" from the following directory: /**siemens**/sinumerik/hmi/template/cfg
2. Store the file in the /**oem**/sinumerik/hmi/cfg or /**user**/sinumerik/hmi/cfg directory.
3. If you use your own icon, then locate it together with the corresponding resolution for HT 8 directory: /**oem**/sinumerik/hmi/ico/ico640 or /**user**/sinumerik/hmi/ico/ico640.
4. Open the file and make the appropriate settings.

Sample file "slckcpf.ini"

```
Template for the configuration of the

; HT8 control panel function menu

;

; To activate the settings remove the

; commentary ';' at the beginning of the line

;; Display settings of the user key softkey leds

[UserKeyLED]

; Filename of the LED icon

;UserKeyLEDIcon = led_green.png

; Alignment of the LED icon

;UserKeyLEDIconAlignment= AlignLeft | AlignTop
```

```
; Use following led map start address instead of calculating DB7.MCP1Out

;UserKeyLEDMap = AB0

; Use the following settings to use this status bits instead of the led map for a
specific sk

;U1LED=/channel/parameter/R[U1,1]

;....

;U16LED=/channel/parameter/R[U1,16]

;VarIncLED = DB11.DBX8.5

;SBLLED = DB21.DBX0.4

;WCSLED = DB19.DBX0.7


; Show a LED for the var inc sk

;showVarIncLED = true

; Show a LED for the var single block sk

;showSBLLED = true

; Show a LED for the var wcs/mcs sk

;showWCSLED = true
```

List of abbreviations/acronyms

A

Abbreviation	Meaning
ASCII	American Standard Code for Information Interchange: American coding standard for the exchange of information
BAG	Mode group
OPI	Operator Panel Interface
CNC	Computerized Numerical Control: Computerized numerical control
CEC	Cross Error Compensation: Sag compensation
DIN	Deutsche Industrie Norm
DIR	Directory: Directory
DRAM	Dynamic Random Access Memory
ESR	Extended Stop and Retract
FRAME	Data block (FRAME)
FIFO	First In - First Out: Method of storing/retrieving data in/from a memory.
GUD	Global User Data: Global user data
MSD	Main Spindle Drive
HSC	High Speed Cutting: High-speed machining
INC	Increment: Incremental dimension
INI	Initializing Data: Initializing data
IPO	Interpolator
ISO	International Standard Organization
JOG	Jogging: Setup mode
LED	Light Emitting Diode: Light emitting diode
LUD	Local User Data: Local user data
MB	Megabyte
MD	Machine data
MDA	Manual Data Automatic: Manual input
MCS	Machine Coordinate System
MLFB	Maschinenlesbare Fabrikatbezeichnung
MPF	Main Program File: NC part program (main program)
MCP	Machine Control Panel: Machine control panel
NC	Numerical Control: Numerical control
NCK	Numerical Control Kernel: NC kernel with block preparation, traversing range, etc.
NCU	Numerical Control Unit: NCK hardware unit
ZO	Zero offset
OEM	Original Equipment Manufacturer
OP	Operator Panel
PCU	Programmable Control Unit

Abbreviation	Meaning
PI service	Program Invocation Services
PG	Programming device
PLC	Programmable Logic Control
REF	REFerence point approach function
REPOS	REPOSition function
ROV	Rapid Override: Input correction
RPA	R-Parameter Active: Memory area in NCK for R- NCK for R parameter numbers
SBL	Single Block: Single block
SD	Setting Data
SDB	System Data Block
SEA	Setting Data Active: Identifier (file type) for setting data
SK	Softkey
SPF	Sub Program File: Subroutines
SRAM	Static Random Access Memory: Static RAM (non-volatile)
SW	Software
SYF	System Files: System files
TEA	Testing Data Active: Identifier for machine data
TMA	Tool Magazine Active: Magazine data
TO	Tool Offset: Tool offset
TOA	Tool Offset Active: Identifier (file type) for tool offsets
UFR	User frame
FD	Feed Drive
WCS	Workpiece Coordinate System
TM	Tool Management

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SIEMENS

SINUMERIK

SINUMERIK 840D sl Easy Screen (BE2)

Programming Manual

Valid for

Control:
SINUMERIK 840D sl/840DE sl

Software:
CNC software V4.4
SINUMERIK Operate V4.4

09/2011
6FC5397-1DP40-2BA0

Legal information

Warning notice system

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 product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

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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.

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Table of contents

Introduction 1

1.1 "Easy Screen" range of functions

Overview

"Easy Screen" is implemented with an interpreter and configuration files containing descriptions of the user interfaces.

"Easy Screen" is configured using ASCII files: These configuration files contain the description of the user interface. The syntax that must be applied in creating these files is described in the following chapters.

The "Easy Screen" interpreter can be used to create user interfaces that display functional expansions designed by the machine manufacturer or user, or simply to implement your own layout on the HMI. Preconfigured user interfaces supplied by Siemens or the machine manufacturer can be modified or replaced.

Part programs, for example, can be edited on user interfaces created by users. Dialogs can be created directly on the control system.

Basic configuration

The "Easy Screen" function enables machine manufacturers to configure their own dialogs. Even with the basic configuration, it is possible to configure 5 screens in the operator menu tree or for customer-specific cycle dialogs.

Software option

To expand the number of dialogs, you require the following Software option:

"SINUMERIK Operate Runtime license OA Easy Screen"

Supplementary Conditions

The following conditions must be met:

- It is only possible to switch between dialogs within a single operating area.
- User, setting, and machine data are initialized on request.
- User variables may not have the same names as system or PLC variables.
- The dialogs activated by the PLC form a separate operating area (similar to measuring cycle screens).
- The cycle support (//C ...) is no longer supported by the software.

Tools

An additional graphics program is needed to produce graphics/display images.

Use

You can implement the following functions:

1. Display dialogs containing the following elements:
   - Softkeys
   - Variables
   - Texts and Help texts
   - Graphics and Help displays
2. Open dialogs by:
   - Pressing the (start) softkeys
   - Selection from the PLC
3. Restructure dialogs dynamically:
   - Edit and delete softkeys
   - Define and design variable fields
   - Insert, exchange and delete display texts (language-dependent or independent)
   - Insert, exchange and delete graphics
4. Initiate operations in response to the following actions:
   - Displaying dialogs
   - Input values (variables)
   - Select a softkey
   - Exiting dialogs
5. Data exchange between dialogs
6. Variables
   - Read (NC, PLC and user variables)
   - Write (NC, PLC and user variables)
   - Combine with mathematical, comparison or logic operators
7. Execute functions:
   - Subroutines
   - File functions
   - PI services
8. Apply protection levels according to user classes

1.2 Fundamentals of Configuration

Configuration files

The defining data for new user interfaces are stored in configuration files. These files are automatically interpreted and the result displayed on the screen. Configuration files are not stored in the software supplied and must be set up by the user.

Note

The description can also be explained using comments. A ";" is inserted as comment character before every explanation.

An ASCII editor (e.g. Notepad or the HMI editor) is used to create configuration files.

Note

If you create or edit the files, use an editor that supports UTF-8 coding.

Menu tree principle

Several interlinked dialogs create a menu tree. A link exists if you can switch from one dialog to another. You can use the newly defined horizontal/vertical softkeys in this dialog to call the preceding or any other dialog.

A menu tree can be created behind each start softkey:

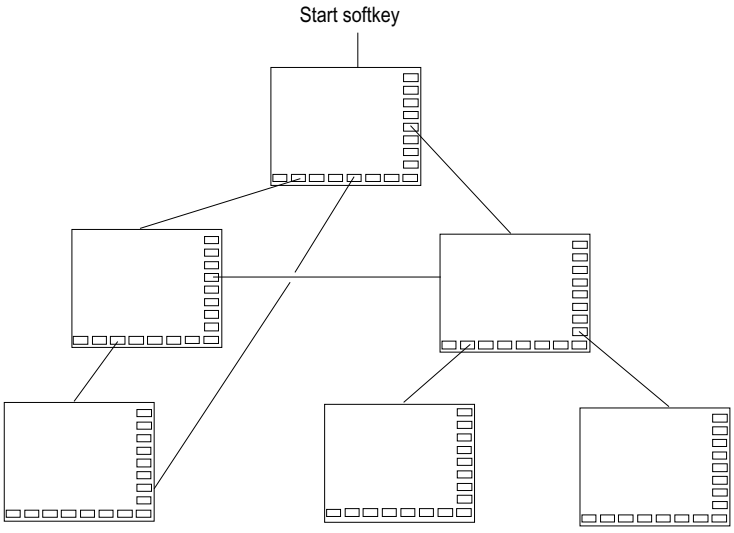


Figure 1-1 Menu tree

Start softkeys

One or more softkeys (start softkeys), which are used to initiate your own operating sequences, are defined in one of the specified configuration files.

The loading of a dedicated dialog is associated with a softkey definition or another softkey menu. These are then used to perform the subsequent actions.

Pressing the start softkey loads the assigned dialog. This will also activate the softkeys associated with the dialog. Variables will be output to the standard positions unless specific positions have been configured.

Reverting to the standard application

You can exit the newly created user interfaces and return to the standard application.

You can use the <RECALL> key to close new user interfaces if you have not configured this key for any other task.

Note

Calling dialogs in the PLC user program

Dialogs can be selected from the PLC as well as via softkeys: An interface signal is available in DB19.DBB10 for signal exchange between the PLC → HMI.

Creating a configuration file as ASCII file

Dialogs can contain, for example, the following elements:

- Input/output fields (variables) with
  - Short text
  - Graphic text
  - Text for units
- Screens
- Softkey menus
- Tables

1.3 Structure of configuration file

Overview

Each HMI application has permanent start softkeys, which can be used to access newly generated dialogs.

Other files:

In the event of "Load a screen form" (LM) or a "Load softkey menu" (LS) call in a configuration file, a new file name containing the object called can be specified. This makes it possible to structure the configuration, e.g., all functions in one operating level in a separate configuration file.

Converting texts from other HMI applications

Procedure to convert a text file with code page coding to text-coding UTF-8:

1. Open the text file on a PG/PC in a text editor.
2. When saving, set the UTF-8 coding (see above "Formatting text files"

The read-in mechanism via code page code is still supported. In order to activate this mechanism in the easyscreen.ini file, the following entry is required:

```
[Compatibility]

UseTextCodecs = true
```

Note

Constraint

In the supplied version of easyscreen.ini, this entry is not available, therefore, text files with UTF-8 coding are expected.

If the entry is supplemented, the old mechanism becomes effective again with the following restriction: It does not function correctly for Asian languages.

Storage location for configuration files

The configuration files are located on the CF card in the `/user/sinumerik/hmi/proj` directory and in the add_on and oem directories accordingly.

Structure of the configuration file

A configuration file consists of the following elements:

1. Description of the start softkeys
2. Definition of dialogs
3. Definition of variables
4. Description of the blocks
5. Definition of a softkey menu

Note

Sequence

The specified sequence in the configuration file must be maintained.

Example:

```
//S (START)                          ;    Definition of the start softkey (optional)
....
//END
//M (.....)                          ;    Definition of the dialog
DEF .....                            ;    Definition of variables
LOAD                                 ;    Description of the blocks
...
END_LOAD
UNLOAD
...
END_UNLOAD
...
//END
//S (...)                            ;    Definition of a softkey menu
//END
```

1.4 Troubleshooting (log book)

Overview

The log book is the easyscreen_log.txt file to which error messages generated by syntax interpretation are written.

The file easyscreen_log.txt is supplied in the following directory:

```
/user/sinumerik/hmi/log/
```

Example:

```
DEF VAR1 = (R)
DEF VAR2 = (R)
LOAD
VAR1 = VAR2 + 1           ; Error message in log book, as VAR2 has no value
```

Syntax

The system does not start to interpret syntax until the start softkey has been defined and a dialog with start and end identifiers as well as a definition line has been configured.

```
//S(Start)
HS6=("1st screen")
PRESS(HS6)
  LM("Maske1")
END_PRESS
//END

//M(Maske1)
  DEF Var1=(R)
//END
```

Contents of easyscreen_log.txt

If "Easy Screen" detects errors when interpreting the configuration files, these errors will be written to the easyscreen_log.txt ASCII file. The file will be deleted each time the HMI is restarted.

The file indicates:

- The action during which an error occurred
- The line and column number of the first faulty character
- The entire faulty line of the configuration file

How do I create a configuration? 2

2.1 Defining start softkeys

Dialog-independent softkey

Start softkeys are dialog-independent softkeys which are not called from a dialog, but which have been configured **before** the first new dialog. In order to access the start dialog or a start softkey menu, the start softkey must be defined.

Programming

The definition block for a start softkey is structured as follows:

```
//S(Start)                  ;start identifier of start softkey
HS1=(...)                   ; defining the start softkey: horizontal SK 1
PRESS(HS1)                  ;method
  LM...                     ;LM or LS function
END_PRESS                   ;end of method
//END                       ;end identifier of start softkey
```

Permissible positions for start softkeys

The following positions for Easy Screen start softkeys are permissible in the operating areas:

Operating area	Position
Machine	HSK6
Parameter	HSK7
Program	HSK6 Measuring cycles: HSK13 and HSK14
Program manager	HSK2-8 and HSK12-16, if not assigned to drives.
Diagnostics	HSK7
Commissioning	HSK7

Start softkeys are configured in special files. The names of these files are stated in the easyscreen.ini file. They usually have a name which is specific to an operating area (e.g. startup.com for the Startup area). This does not apply to the machine operating area, where there are a number of files specific to operating modes (ma_jog.com, ma_auto.com).

The softkey menu with the start softkeys is called "Start". Existing configurations for start softkeys can still be used. The function whereby start softkeys are merged with the softkeys for the respective HMI application (operating area) in the start softkey menu is not supported. This means that until the first dialog call is made - in other words, the time at which full functionality becomes available (e.g. execution of PRESS blocks) - menus or softkey menus can only be replaced by others in their entirety.

Menus for standard applications are given the "easyscreenmode" menu property as part of their XML configuration. This indicates whether the menu involved permits the use of Easy Screen start softkeys (= easyscreen) or not (= off):

```
<SCREEN name="SlEasyScreenTest">
  <FORM ... >
      <PROPERTY ... > ... </PROPERTY>
  </FORM>
    <MENU name="menu_horiz" softkeybar="hu" easyscreenmode="easyscreen" />
    <MENU name="menu_vert" softkeybar="vr" easyscreenmode="off" />
</SCREEN>
```

Example

Separate start softkey menus can be defined for horizontal and vertical menus. The "MENU" attribute is used for this purpose.

If a new menu is displayed in an HMI application and this menu permits the use of start softkeys in accordance with the configuration (easyscreenmode = "easyscreen"), a search will first be performed for the "MENU" attribute in the configuration of the start softkey menu:

- If a configuration for a start softkey menu with the "MENU" attribute is found and if the "MENU" attribute contains the name of the menu that is currently being displayed (in the example: "menu_horiz"), then this start softkey menu is displayed.

  Only the horizontal softkeys are taken into account here, as the "menu_horiz" menu involves a horizontal menu bar.

- Where there is no menu-specific softkey menu for a particular menu (i.e. the "MENU" attribute is not available), the default start softkey menu will be loaded.

```
//S(Start)
  MENU="menu_horiz"
  HS2=("Contour",ac6,se3)
    PRESS(HS2)
      LS("Contour")
    END_PRESS
  ...
//END
```

Template for configurations

A detailed description of all permissible positions for start softkeys and their configuration is located in the easyscreen.ini file in the following directory:

```
/card/siemens/sinumerik/hmi/cfg
```

This file is used as a template for your own configurations.

See also

Lists of start softkeys (Page 167)

2.1.1 Functions for start softkeys

Functions for dialog-independent softkeys

Only certain functions can be initiated with start softkeys.

The following functions are permitted:

- The **LM function** can be used to load another dialog: **LM***("Identifier"["File"])*
- The **LS function** can be used to display another softkey menu: **LS***("Identifier"[, "File"][, Merge])*
- You can use the **"EXIT" function** to exit newly configured user interfaces and return to the standard application.
- You can use the **"EXITLS" function** to exit the current user interface and load a defined softkey menu.

PRESS method

The softkey is defined within the definition block and the "LM" or "LS" function is assigned in the PRESS method.

If the start softkey definition is designated as a comment (semicolon (;) at beginning of line) or the configuration file removed, the start softkey will not function.

```
//S(Start)                          ;   Start identifier
HS6=("1st screen form")             ;   horizontal SK 6 labeled "1st screen form"
PRESS(HS6)                          ;   PRESS method for horizontal SK 6
  LM("Screen form1")                ;   Load screen form1 function, where screen form
                                        1 must be defined within the same file.
END_PRESS                           ;   End of PRESS method
HS7=("2nd screen form")             ;   horizontal SK 7 labeled "2nd screen form"
PRESS(HS7)                          ;   PRESS method for horizontal SK 7
  LM("Screen form2")                ;   Load screen form2 function, where screen form
                                        2 must be defined within the same file.
END_PRESS                           ;   End of PRESS method
//END                               ;   End identifier of entry block
```

Example

```
HS1 = ("new softkey menu")
HS2=("no function")
PRESS(HS1)
  LS("Menu1")                               ;    load new softkey menu
END_PRESS
PRESS (HS2)                                 ;    empty PRESS method
END_PRESS
```

Configuration

The names of the files containing the configuration for the start softkey menus are given in the easyscreen.ini file. The entry can be specific to the operating area, the dialog, or the screen. For example:

```
StartFile01 =      area := SlGfwTest,
                   dialog := SlGfwTestDialog,
                   screen := SlEasyScreenTest,
                   startfile := test.com
StartFile02 =      area := AreaMachine,
                   dialog := SlMachine,
                   screen := Jog,
                   startfile := ma_jog.com
StartFile03 =      area := AreaMachine,
                   dialog := SlMachine,
                   screen := Auto,
                   startfile := ma_auto.com
StartFile04 =      area := AreaProgramManager,
                   dialog := ,
                   screen := ,
                   startfile := progman.com
StartFile05 =      area := AreaProgramEdit,
                   dialog := ,
                   screen := ,
                   startfile := aeditor.com
StartFile06 =      area := AreaStartup,
                   dialog := SlSuDialog,
                   screen := ,
                   startfile := test.com
```

The names given in the systemconfiguration.ini file should be used for "area" and "dialog". The screen identifiers in the dialog configuration should be used for "screen"; "startfile" refers to the file in which the start softkey menu (default or menu-specific) is configured.

If a menu-specific start softkey menu is required, an additional name is provided by the attribute "menu", e.g.:

```
StartFile01 =      area := SlGfwTest,
                   dialog := SlGfwTestDialog,
                   screen := SlEasyScreenTest,
                   menu := menu_horiz,
                   startfile := test.com
```

Various configurations of the start softkeys

Various configurations of the start softkeys are merged. In this case, initially the name of the file to be interpreted is read-out of easyscreen.ini. A search is made for files with the .com extension in the following directories:

- /user/sinumerik/hmi/proj/
- /oem/sinumerik/hmi/proj/
- /addon/sinumerik/hmi/proj/
- /siemens/sinumerik/hmi/proj/

The configurations included for the start softkeys are now merged to form a configuration, i.e. the individual softkeys are compared. If there are two or more configurations for a softkey, the higher order is always transferred into the merge version.

Softkey menus or dialogs that are possibly included are ignored. If a softkey has a command without file information e.g. `LM ("test")`, as the required softkey menu or dialog is contained in the same file, then the corresponding file name is supplemented in the internal merge version so that in this case, no changes are required. The merge configuration contained is then subsequently displayed.

"System" parameter in the easyscreen.ini file

Dialogs can be displayed on different systems.

Default setting: System = 1

If dialogs are based on a value of 0, the value can be adapted by entering the following in easyscreen.ini:

[SYSTEM]

System = 0

2.2 Structure and elements of a dialog

2.2.1 Defining a dialog

Definition

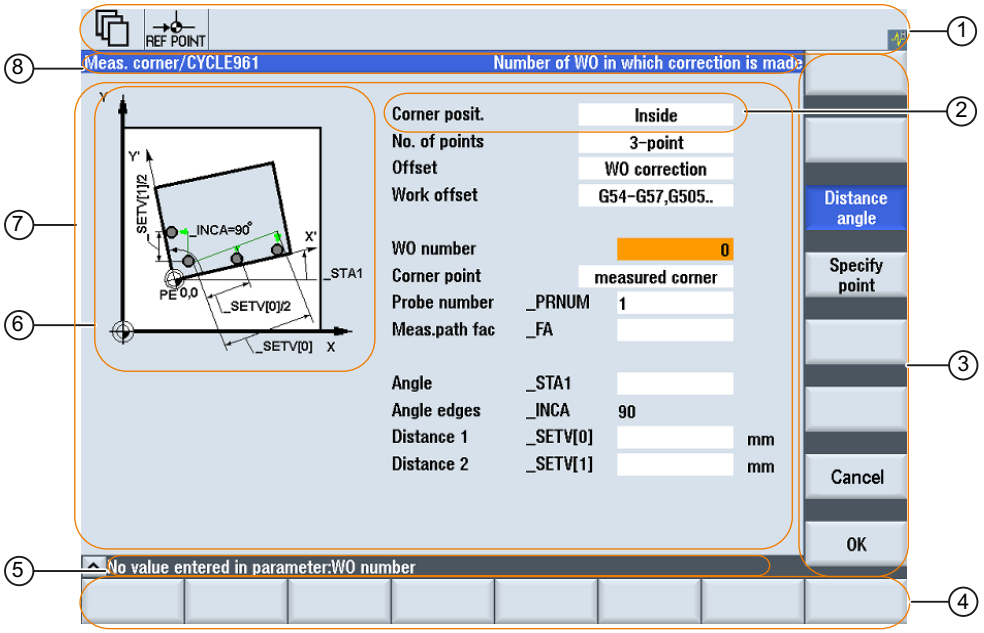
A dialog is part of a user interface consisting of a display line, dialog elements and/or graphics, an output line for messages and 8 horizontal and 8 vertical softkeys.

Dialog elements are:

- Variables
  - Limits/toggle field
  - Default setting of variables
- Help display
- Texts
- Attributes
- System or user variable
- Position of short text
- Position of input/output field
- Colors

Dialog properties:

- Header
- Graphic
- Dimension
- System or user variable
- Graphic position
- Attributes



① Machine status display ("header")
② Dialog element
③ 8 vertical softkeys
④ 8 horizontal softkeys
⑤ Displaying messages
⑥ Graphic
⑦ Dialog
⑧ Header line of the dialog with header and long text

Figure 2-1 Structure of the dialog

Overview

The definition of a dialog (definition block) is basically structured as follows:

Definition block	Comment	Chapter reference
`//M...`	;Dialog start identifier	
`DEF Var1=...` `...`	;Variables	See chapter "Variables"
`HS1=(...)` `...`	;Softkeys	See chapter "Softkey menus"

`PRESS(HS1)`
`  LM...`
`END_PRESS`
	;Method start identifier
	;Actions
	;Method end identifier
		See chapter "Methods"

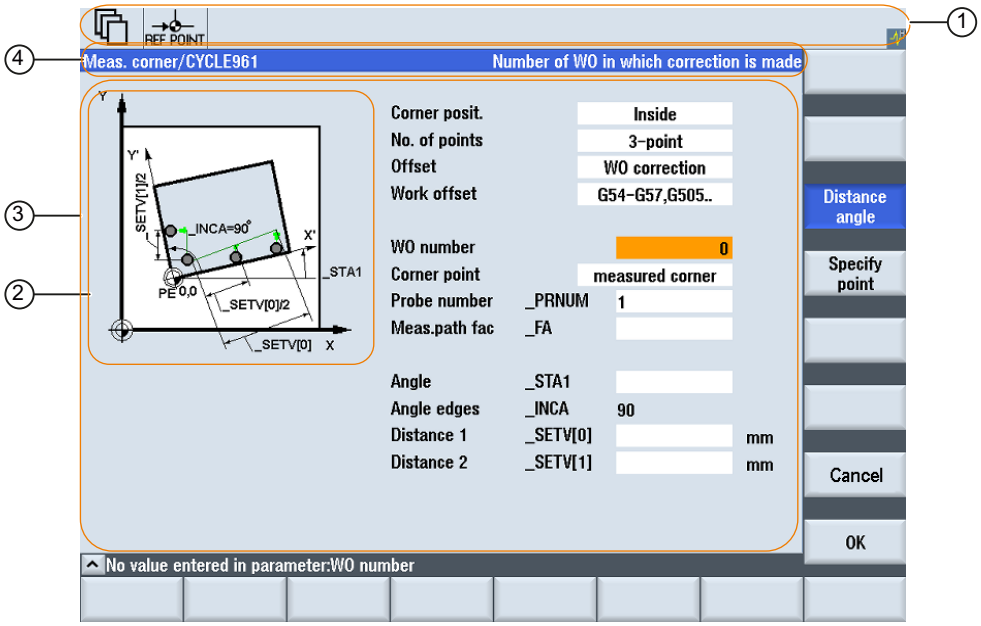
`//END`	;Dialog end identifier	

Within the dialog definition block, various variables that appear as dialog elements in the dialog, as well as horizontal and vertical softkeys, are defined first. Different types of actions are then configured in methods.

2.2.2 Defining dialog properties

Description

The properties of the dialog are defined in the start identifier line of the dialog.



① Machine status display ("header")
② Graphic
③ Dialog
④ Header line of the dialog with header and long text

Figure 2-2 Dialog properties

Programming

Syntax:	**//M**(Identifier/[Header]/[Graphic]/[Dimension]/[System or user variable]/[Graphic position]/[Attributes])	
Description:	Defines a dialog	
Parameters:	Identifier	Name of the dialog
	Header	Dialog header as text or call for text (e.g. $85011) from a language-specific text file.
	Graphic	Graphics file with path in double quotation marks
	Dimension	Position and size of the dialog in pixels (distance from left-hand side, distance from right-hand side, width, height), in relation to the upper left-hand corner of the screen. The entries are separated by a comma.
	System or user variable	System or user variable to which the current cursor position is assigned. The NC or PLC can be provided with the cursor position via the system or user variable. The first variable has the index 1. The order corresponds to the configuration order of the variables.
	Graphic position	Position of the graphic in pixels (distance from left-hand side, distance from right-hand side), in relation to the upper left-hand corner of the dialog. The minimum clearance from the top is 18 pixels. The entries are separated by a comma.
	Attributes	The specifications of the attributes are separated by a comma.
		Possible attributes are:
	CMx	Column mode: Column alignment
		CM0 Default setting: The column distribution is carried out separately for each line.
		CM1 The column distribution of the line with the most columns applies to all lines.
	CB	CHANGE block: Response when dialog is opened: cb attributes specified for a variable in a variables definition take priority over the default setting in the dialog definition.
		CB0 Default setting: All CHANGE blocks associated with the dialog are processed when it is opened.
		CB1 CHANGE blocks are then only processed if the relevant value changes.

Accessing the dialog properties

Read and write access to the following dialog properties is permitted within methods (e.g. PRESS block).

- Hd = Header
- Hlp = Help display
- Var = System or user variable

Example

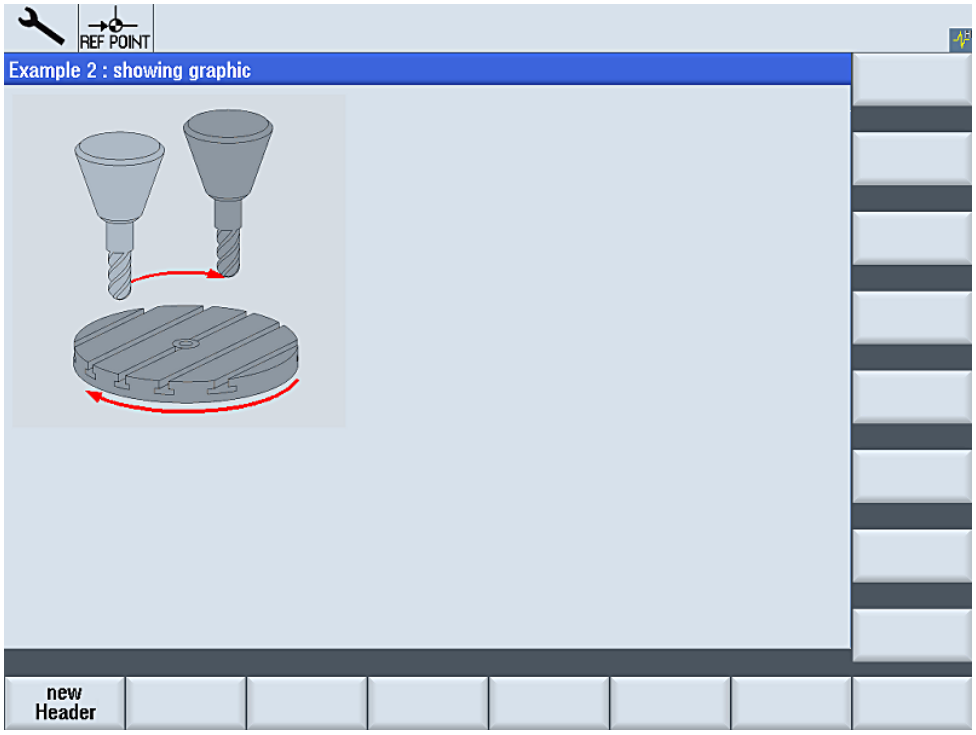


Figure 2-3 "Example 2: showing graphic"

```
//S(Start)
HS7=("Example", se1, ac7)

PRESS(HS7)
  LM("Mask2")
END_PRESS

//END
//M(Mask2/"Example 2 : showing graphic"/"example.png")
HS1=("new%nHeader")
HS2=("")
HS3=("")
HS4=("")
HS5=("")
HS6=("")
HS7=("")
HS8=("")
VS1=("")
VS2=("")
VS3=("")
VS4=("")
VS5=("")
VS6=("")
VS7=("")
VS8=("")

PRESS(HS1)
  Hd= "new Header"
END_PRESS
...
//END
```

See also

Programming example for the "Custom" area (Page 161)

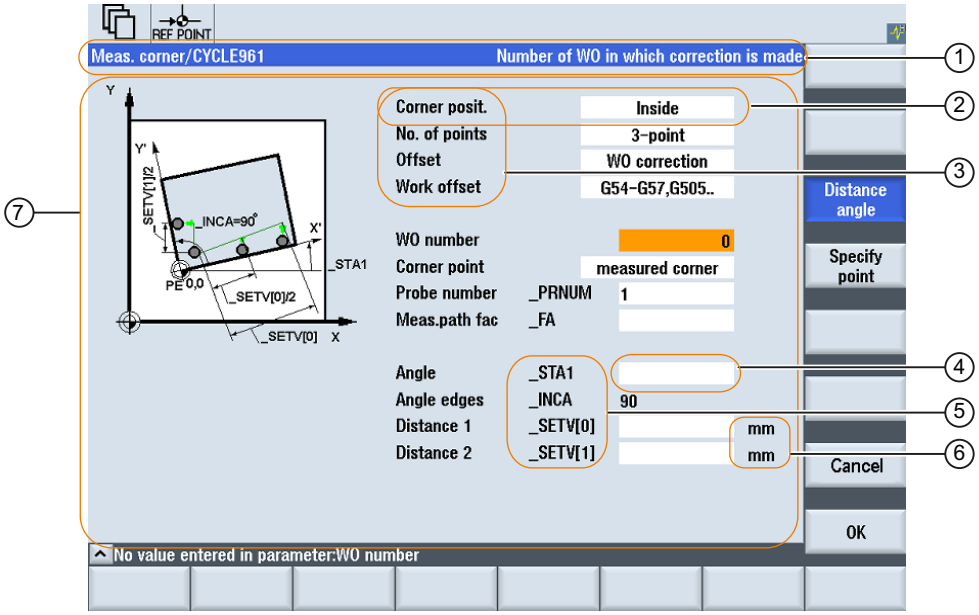
2.2.3 Defining dialog elements

Dialog element

The term "dialog element" refers to the visible part of a variable, i.e., short text, graphics text, input/output field and unit text. Dialog elements fill lines in the main body of the dialog. One or more dialog elements can be defined for each line.

Variable properties

All variables are valid in the active dialog only. Properties are assigned to a variable when it is defined. The values of dialog properties can be accessed within methods (e.g. a PRESS block).



① Header line of the dialog with header and long text
② Dialog element
③ Short text
④ Input/output field
⑤ Graphic text
⑥ Text for units
⑦ Main body of the dialog

Figure 2-4 Elements of a dialog

Programming - Overview

The single parameters to be separated by commas are enclosed in round parentheses:

DEF *Identifier* =	**Identifier = Name of variable**
	Variable type
	/[Limit values or toggle field]
	/[Default]
	/[Texts (Long text, Short text|Image, Graphic text, Units text)]
	/[Attributes]
	/[Help display]
	/[System or user variable]
	/[Position of short text]
	/[Position of I/O field(Left, Top, Width, Height)]
	/[Colors]
	/[online help] (Page 41)

See also

Variable parameters (Page 52)

2.2.4 Example Opening the Dialog

Programming

The new "Example" dialog is called via the "Example" start softkey from the "Startup" operating area:

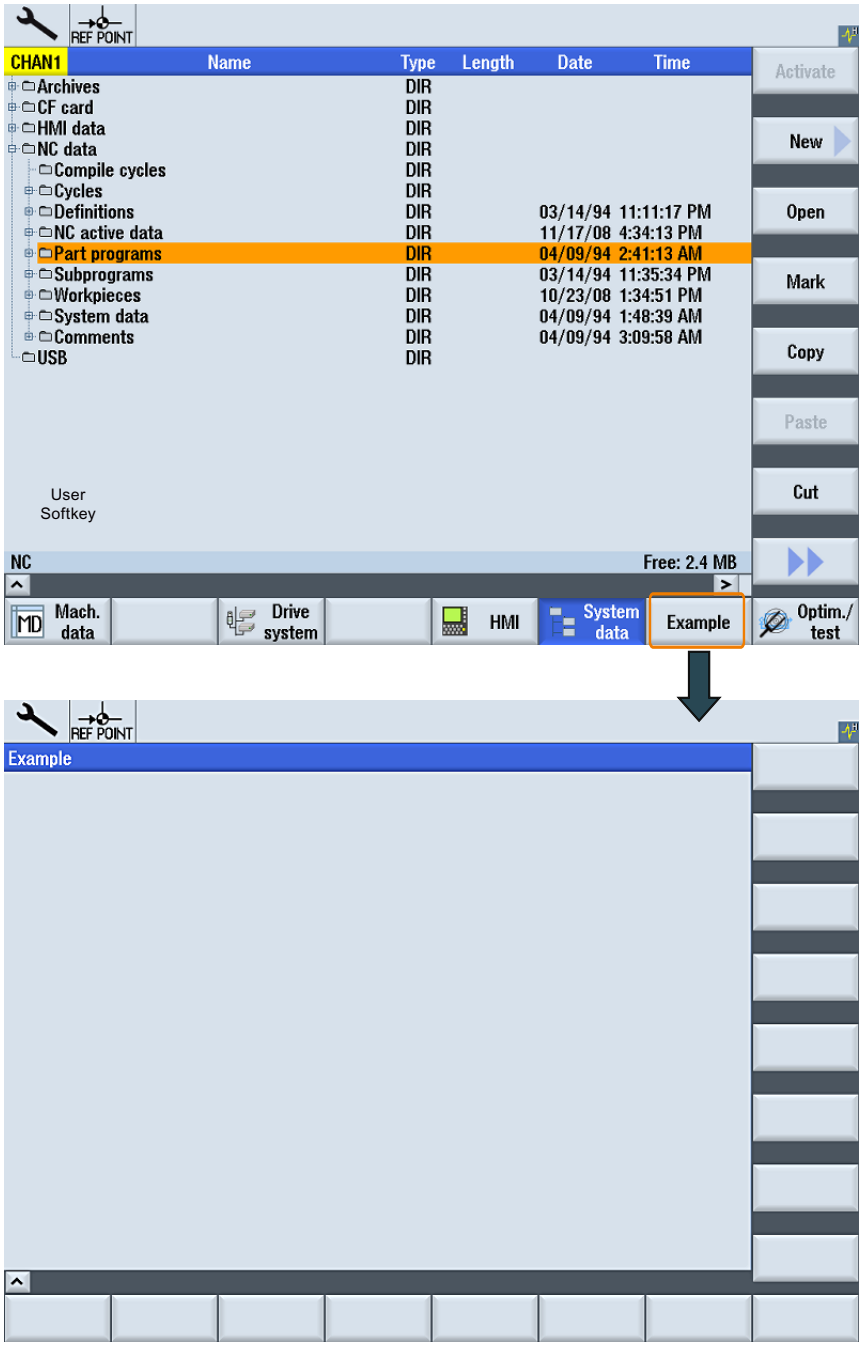


Figure 2-5 Example: Calling a new dialog

```
//S(Start)
HS7=("Example", ac7, se1)

PRESS(HS7)
  LM("Maske1")
END_PRESS

//END
//M(Maske1/"Example")
HS1=("")
HS2=("")
HS3=("")
HS4=("")
HS5=("")
HS6=("")
HS7=("")
HS8=("")
VS1=("")
VS2=("")
VS3=("")
VS4=("")
VS5=("")
VS6=("")
VS7=("")
VS8=("")
...                                          ;  Methods
//END
```

2.2.5 Defining dialogs with multiple columns

Overview

Multiple variables can also be represented in a dialog on one line. In this case, the variables are all defined in the configuration file on a single definition line.

```
DEF VAR11 = (S///"Var11"), VAR12 = (I///"Var12")
```

To make individual variables in the configuration file more legible, the definition lines can be wrapped after every variables definition and following comma.

The key word "DEF" always indicates the beginning of a new line:

```
DEF Tnr1=(I//1/"","T ",""/wr1///,,10/20,,50),
  TOP1=(I///,"Type="/WR2//"$TC_DP1[1,1]"/80,,30/120,,50),
  TOP2=(R3///,"L1="/WR2//"$TC_DP3[1,1]"/170,,30/210,,70),
  TOP3=(R3///,"L2="/WR2//"$TC_DP4[1,1]"/280,,30/320,,70),
  TOP4=(R3///,"L3="/WR2//"$TC_DP5[1,1]"/390,,30/420,,70)
DEF Tnr2=(I//2/"","T ",""/wr1///,,10/20,,50),
  TOP21=(I///,"Typ="/WR2//"$TC_DP1[2,1]"/80,,30/120,,50),
  TOP22=(R3///,"L1="/WR2//"$TC_DP3[2,1]"/170,,30/210,,70),
  TOP23=(R3///,"L2="/WR2//"$TC_DP4[2,1]"/280,,30/320,,70),
  TOP24=(R3///,"L3="/WR2//"$TC_DP5[2,1]"/390,,30/420,,70)
...
```

NOTICE

When creating dialogs with multiple columns, the options and limits of the hardware being used should be taken into consideration in terms of the number of columns and DEF instructions. A lot of columns can slow down the system.

2.2.6 Using display images/graphics

Use of graphics

There are two display categories:

- Display images/graphics in the graphic area
- Help displays illustrating, for example, individual variables, which are superimposed in the graphic area.
- More Help displays can be configured instead of short text or an input/output field, which you position where you like.

Storage locations

First, the relevant resolution directory is searched for the display image corresponding to the resolution of the connected monitor. If it is not found there, a search is performed for the display image in the next smaller resolution directory until – if the display image is not found earlier – directory ico640 is reached:

Search sequence:

```
/user/sinumerik/hmi/ico/ico<Resolution>
/oem/sinumerik/hmi/ico/ico<Resolution>
/addon/sinumerik/hmi/ico/ico<Resolution>
```

Note

Graphics are proportionally positioned for resolutions 640 x 480, 800 x 600 and 1024 x 768 pixels.

2.3 Defining softkey menus

Definition

The term softkey menu is used to refer to all the horizontal and vertical softkeys displayed on a screen form. In addition to the existing softkey menus, it is possible to define other menus, which partially or completely overwrite the existing menus.

The names of the softkeys are predefined. Not all softkeys need to be assigned.

HSx x 1 - 8, Horizontal softkeys 1 to 8

VSy y 1 - 8, Vertical softkeys 1 to 8

The definition of a softkey menu (softkey menu definition block) is basically structured as follows:

Definition block	Comment	Chapter reference
`//S...`	;Start identifier of softkey menu	
`HSx=...`	;Define softkeys	

`PRESS(HSx)`
`  LM...`
`END_PRESS`
	;Method start identifier
	;Actions
	;Method end identifier
		See chapter "Methods"

`//END`	;End identifier of softkey menu	

Description

Properties are assigned to softkeys during definition of the softkey menu.

Programming

Syntax:	***//S****(Identifier)*	;Start identifier of softkey menu
	...	
	//END	;End identifier of softkey menu
Description:	Defines softkey menu	
Parameters:	Identifier	Name of softkey menu

Syntax:	**SK =** *(Text[, Access level][, Status])*	
Description:	Define softkey	
Parameters:	SK	Softkey, e.g. HS1 to HS8, VS1 to VS8
	Text	Enter text
	Display file name	"\\my_pic.png"
		or via separate text file $85199, e.g. with the following text in the (language-specific) text file: 85100 0 0 "\\my_pic.png".
		The size of image which can be displayed on a softkey depends on the OP used:
		OP 010: 640 X 480 mm → 25 x 25 pixels
		OP 012: 800 X 600 mm → 30 x 30 pixels
		OP 015: 1024 X 768 mm → 40 x 40 pixels
	Access level	ac0 to ac7 (ac7: default)
	Status	se1: visible (default)
		se2: disabled (gray text)
		se3: displayed (last softkey used)

Note

Enter %n in the softkey text to create a line break.

A maximum of 2 lines with 9 characters each are available.

Assigning access level

Operators can only access information on this and lower access levels. The meanings of the different access levels are as follows: ac0 is the highest access level and ac7 the lowest.

Security level	Locked by	range
ac0	Password	Siemens
ac1	Password	Machine manufacturer
ac2	Password	Service
ac3	Password	User
ac4	Keylock switch position 3	Programmer, machine setter
ac5	Keylock switch position 2	Qualified operator
ac6	Keylock switch position 1	Trained operator
ac7	Keylock switch position 0	Semi-skilled operator

Example

```
//S(Menu1)                          ;   Start identifier of softkey menu
HS1=("NEW", ac6, se2)               ;   Define softkey HS1, assign the label "NEW",
                                        protection level 6, and the status "disabled"
HS2=("\\image1.png")                ;   Assign a graphic to the softkey
HS3=("Exit")


VS1=("sub screen form")
VS2=($85011, ac7, se2)              ;   Define softkey VS2, assign the text from the
                                        language file, protection level 1, and the
                                        status "disabled".
VS3=("Cancel", ac1, se3)            ;   Define softkey VS3, assign the label "Cancel",
                                        protection level 1 and the status
                                        "highlighted".
VS4=("OK", ac6, se1)                ;   Define softkey VS4, assign the label "OK",
                                        protection level 6 and the status "visible"
VS5=(SOFTKEY_CANCEL,,se1)           ;   Define cancel standard softkey VS5 and assign
                                        the status "visible"
VS6=(SOFTKEY_OK,,se1)               ;   Define OK standard softkey VS6 and assign the
                                        status "visible"
VS7=(["\\image1.png","OEM           ;   Define softkey VS7, assign an image, assign the
text"],,se1)                            label "OEM Text" and the status "visible"
VS8=(["\\image1.png",               ;   Define softkey VS8, assign an image, assign
$83533],,se1)                           text from language file and the status
                                        "visible"
```

```
PRESS(HS1)                      ;   Method start identifier
  HS1.st="Calculate"            ;   Assign a label text to the softkey
...
END_PRESS                       ;   Method end delimiter

PRESS(RECALL)                   ;   Method start identifier
  LM("Screen form21")           ;   Load dialog
END_PRESS                       ;   Method end delimiter
//END                           ;   Softkey menu end identifier
```

2.3.1 Changing softkey properties during runtime

Description

The softkey properties Text, Access Level and Status can be changed in the methods during runtime.

Programming

Syntax:	SK.st = "Text"	;Softkey with label
	SK.ac = Access level	;Softkey with security level
	SK.se = Status	; Softkey with status
Description:	Assign properties	
Parameters:	Text	Label text in inverted commas
	Access level	Range of values: 0 ... 7
	Status	1:visible and operator-controllable
		2:disabled (gray text)
		3:displayed (last softkey used)

Example

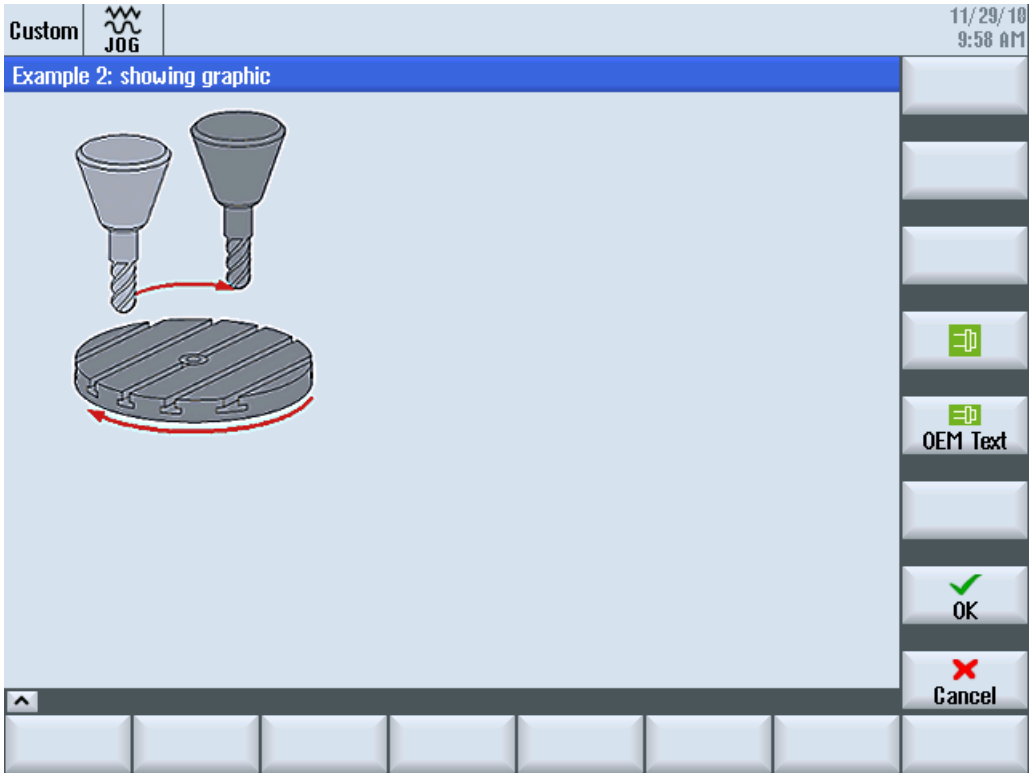


Figure 2-6 Example 3: Graphics and softkeys

```
//S(Start)
HS7=("Example", ac7, se1)

PRESS(HS7)
  LM("Maske3")
END_PRESS

//END

//M(Maske3/"Example 2: showing graphic"/"example.png")
HS1=("")
HS2=("")
HS3=("")
HS4=("")
HS5=("")
HS6=("")
HS7=("")
HS8=("")
```

```
VS1=("")
VS2=("")
VS3=("")
VS4=("\\sp_ok.png",,SE1)
VS5=(["\\sp_ok_small.png","OEM Text"],,SE1)
VS6=("")
VS7=(SOFTKEY_OK,,SE1)
VS8=(SOFTKEY_CANCEL,,SE1)
PRESS(VS4)
  EXIT
END_PRESS
PRESS(VS5)
  EXIT
END_PRESS
PRESS(VS7)
  EXIT
END_PRESS
PRESS(VS8)
  EXIT
END_PRESS
//END
```

2.3.2 Language-dependent text

Overview

Language-dependent texts are used for:

- Softkey labels
- Headings
- Help texts
- Any other texts

The language-dependent texts for dialogs are stored in text files.

The text files are stored in the following directories:

- /user/sinumerik/hmi/lng/
- /oem/sinumerik/hmi/lng/
- /addon/sinumerik/hmi/lng/

alsc.txt	Contains the language-dependent texts for the Siemens standard cycles
almc.txt	Contains the language-dependent texts for the manufacturer cycles
aluc.txt	Language-dependent user texts

The text files used during program runtime are specified in the easyscreen.ini file:

```
[LANGUAGEFILES]

LngFile01 = alsc.txt ;->alsc<_xxx>.txt (e.g. alsc_eng.txt)

LngFile02 = user.txt
```

In this instance, the user.txt file has been chosen as an example of a text file. Any name can be selected, in principle. Depending on the language of the texts within the file, the relevant language code must be added using the following syntax:

```
user.txt → user_xxx.txt (e.g. user_eng.txt)
```

An underscore followed by the relevant language identifier are added after the name.

See also

List of language codes used in file names (Page 172)

Format of text files

The text files must be saved in UTF-8 format.

If, for example, you use Notepad to generate text files, select "File" → "Save As" and choose **UTF-8** encoding.

Format of a text entry

Syntax:	8xxxx 0 0 "Text"		
Description:	Assignment between text number and text in the file		
Parameters:	xxxx	5000 to 9899	Text identification number range reserved for users. You must assign unique numbers.
	"text"		Text that appears in dialog
	%n		Control characters in the text for creating a line break

Parameters 2 and 3 are separated by blanks and act as control characters for alarm text output. To ensure that the text format is identical to that of the alarm texts, these two parameters must always be set to zero.

Examples of alarms:

```
85000 0 0 "Retraction plane"

85001 0 0 "Drilling depth"

85002 0 0 "Pitch"

85003 0 0 "Pocket radius"
```

2.4 Configuring the online help

Online help

An online help for the configured dialogs and elements can be created in the HTML format. The syntax and procedure for the online help is essentially the same as for SINUMERIK Operate, e.g.:

```
DEF VAR14 = (I///,"\\ein.png"/al1,cb1,wr2//"DB1.DBB0"////"sinumerik_md_1.html",
"9100")
```

References

Commissioning Manual "Base software and operating software" (IM9), Chapter "OEM-specific online help"

See also

Defining dialog elements (Page 27)

Variables

3

3.1 Defining variables

Variable value

The most basic property of a variable is its value.

The value of variables can be assigned by means of:

- Default settings when defining variables
- Assignment to a system or user variable
- A method

Programming

Syntax:	Identifier.**val** = Variable value	
	Identifier = Variable value	
Description:	Variable value val (value)	
Parameters:	Identifier:	Name of variable
	Variable value:	Value of variable
Example:	`VAR3 = VAR4 + SIN(VAR5)` `VAR3.VAL = VAR4 + SIN(VAR5)`	

Variable status

The "Variable status" property can be used to scan a variable for valid content during runtime. This property can be read and written with the value FALSE = 0.

Programming

Syntax:	Identifier.**vld**	
Description:	Variable status vld (validation)	
Parameters:	Identifier:	Name of variable
		The result of the scan can be:
		FALSE =invalid value
		TRUE =valid value

Example:	`IF VAR1.VLD == FALSE`
	`  VAR1 = 84`
	`ENDIF`	

Variable: Changing properties

The variables are assigned a new value in the notation *Identifier.Property = Value* when a change is made. The expression to the right of the equality sign is evaluated and assigned to the variable or variable property.

Examples:

Identifier.**ac** = Access level	(ac: access level)
Identifier.**al** = Text alignment	(al: alignment)
Identifier.**bc** = Background color	(bc: back color)
Identifier.**fc** = Foreground color	(fc: front color)
Identifier.**fs** = Font size	(fs: font size)
Identifier.**gt** = Graphic text	(gt: graphic text)
Identifier.**hlp** = Help display	(hlp: help)
Identifier.**li** = Limit	(li: limit)
Identifier.**lt** = long text	(lt: long text)
Identifier.**max** = MAX limits	(max: maximum)
Identifier.**min** = MIN limits	(min: minimum)
Identifier.**st** = short text	(st: short text)
Identifier .**typ** = Variable type	(typ: type)
Identifier.**ut** = Unit text	(ut: unit text)
Identifier.**val** = Variable value	(val: value)
Identifier.**var** = System or user variable	(var: variable)
Identifier.**vld** = Variable status	(vld: validation)
Identifier.**wr** = Input mode	(wr: write)

3.2 Application examples

Help variables

Help variables are internal arithmetic variables. Arithmetic variables are defined like other variables, but have no other properties apart from variable value and status, i.e. Help variables are not visible in the dialog. Help variables are of the VARIANT type.

Programming

Syntax:	DEF *Identifier*	
Description:	Internal arithmetic variables of the VARIANT type	
Parameters:	Identifier:	Name of Help variables

Example

```
DEF OTTO  ;Definition of a Help variable
```

Syntax:	Identifier.val = *Help variable value*	
	Identifier = *Help variable value*	
Description:	A value is assigned to a Help variable in a method.	
Parameters:	Identifier:	Name of Help variables
	Help variable value:	Content of the Help variables

Example:

```
LOAD
  OTTO = "Test"              ;  Assign the value "Test"  to the Otto Help
END_LOAD                        variable.
LOAD
  OTTO = REG[9].VAL          ;  Assign the value of the register to the Otto Help
END_LOAD                        variable.
```

Calculation with variables

Variables are calculated every time you exit an IO field (by pressing the ENTER or TOGGLE key). The calculation is configured in a CHANGE method that is processed every time the value changes.

You can scan the variable status to ascertain the validity of the value of the variable, e.g.,

```
Var1 = Var5 + SIN(Var2)

Otto = PI * Var4
```

Addressing system variables indirectly

A system variable can also be addressed indirectly, i.e., as a function of another variable:

```
PRESS(HS1)
  AXIS=AXIS+1
  WEG.VAR="$AA_DTBW["<<AXIS<<"]"   ;Address axis address via variable
END_PRESS
```

Changing softkey labels

Example

```
HS3.st = "New Text"   ;Change softkey label
```

3.3 Example 1: Assigning the variable type, texts, help display, colors, tooltips

Example 1a

Assigning the Variable type, Texts, Help display, and Colors properties

DEF Var1 = (R///,"Actual value",,"mm"//"Var1.png"////8,2)

Variable Type:	REAL
Limits or entry in the toggle field:	none
Default setting:	None
Texts:	
Long text:	None
Short text:	Actual value
Graphic text:	none
Unit text:	mm
Attributes:	None
Help display:	Var1.png
System or user variable:	None
Position of short text:	No data, i.e., default position
Position of input/output field:	No data, i.e., default position
Colors:	
Foreground color:	8
Background color:	2

Example 1b

Assigning tooltips

DEF Var2 = (I//5/"","value","","," Tooltiptext"/wr2///20,250,50)

Variable type:	INTEGER
Limits or entry in the toggle field:	None
Default setting:	5
Texts:	
Short text:	Value (possible language text ID)
Tooltip:	Tooltip text
Attributes:	
Input mode	Reading and writing
Help display:	None
Position of short text:	
Distance from left	20
Distance from top	250
Width:	50
Colors:	No data, i.e. default

See also

Variable parameters (Page 52)

3.4 Example 2: Assigning the Variable Type, Limits, Attributes, Short Text Position properties

Example 2

Assigning the Variable Type, Limits, Attributes, Short Text Position properties

DEF Var2 = (I/0,10///wr1,al1///,,300)

Variable Type:	INTEGER
Limits or toggle field entries:	MIN: 0
	MAX: 10
Default:	none
Texts:	none
Attributes:	
Input mode	read-only
Alignment of short text	Right-justified
Help display:	none
System or user variable:	none
Position of short text:	
Distance from left	None
Distance from top	None, i.e., default distance from top left
Width:	300
Position of input/output field:	No data, i.e., default position
Colors:	No data, i.e., default
Help:	none

See also

Variable parameters (Page 52)

3.5 Example 3: Assigning the Variable Type, Default, System or User Variable, Input/Output Field Position properties

Example 3

Assigning the Variable Type, Default, System or User Variable, Input/Output Field Position properties

DEF Var3 = (R//10///"$R[1]"//300,10,200//)

Variable Type:	REAL
Limits or toggle field entries:	none
Default setting:	10
Texts:	none
Attributes:	None
Help display:	none
System or user variable:	$R[1] (R-Parameter 1)
Position of short text:	Default position in relation to input/output field
Position of input/output field:	
Distance from left	300
Distance from top	10
Width:	200
Colors:	No data, i.e. default

See also

Variable parameters (Page 52)

3.6 Examples relating to toggle field and image display

Example 4

Various entries in the toggle field:

Limits or toggle field entries:

```
DEF Var1 = (I/* 0,1,2,3)
DEF Var2 = (S/* "In", "Out")
DEF Var3 = (B/* 1="In", 0="Out")  ;1 and 0 are values, "In" and "Out" are displayed.
DEF Var4 = (R/* ARR1)             ;ARR1 is the name of an array.
```

Example 5

Displaying an image instead of a short text: The size and position of the image is defined under "Position of IO field (left, top, width, height)".

DEF VAR6= (V///,"\\image1.png" ////160,40,50,50)

Variable type:	VARIANT
Limits or entries in the toggle field:	None
Default setting:	None
Texts:	
Short text:	image1.png
Attributes:	None
Help display:	none
System or user variable:	None
Position of short text:	
Distance from left:	160
Distance from the top:	40
Width:	50
Height:	50
Position of input/output field:	No details
Colors:	No data, i.e. default

3.7 Variable parameters

Parameter overview

The following overview provides a brief explanation of the variable parameters. Subsequent chapters contain a more detailed description.

Parameter	Description	
Variable type (Page 55)	The variable type must be specified.	
	R[x]:	REAL (+ digit for the decimal place)
	I:	INTEGER
	S[x]:	STRING (+ digit for string length)
	C:	CHARACTER (individual character)
	B:	BOOL
	V:	VARIANT
Limits (Page 49)	Limit value MIN, limit value MAX Default setting: Empty The limit values are separated by a comma. Limits can be specified for types I, C and R in decimal formats or as characters in the form "A", "F".	
Default setting (Page 61)	If no default setting has been configured and no system or user variable has been assigned to the variable, the first element of the toggle field is assigned. If no toggle field has been defined, there is no default setting, which means the status of the variable is "not calculated". Default setting: No default	
Toggle field (Page 59)	List with predetermined entries in the IO field: The list is initiated by a *; the entries are separated by a comma. The entries can be assigned a value. For the toggle field, the entry for the limit is interpreted as a list. If only one * is entered, a variable toggle field is created. Default setting: None	
Texts (Page 47)	The sequence is specified. Instead of a short text, an image can also be displayed. Default setting: Empty	
	Long text:	Text in the display line
	Short text:	Name of the dialog element
	Graphic text:	Text refers to the terms in the graphics
	Unit text:	Unit of the dialog element
	Tooltips (Page 47)	Serve as brief information in a screen form configuration for the display and toggle fields. The information is configured via plain text and language text ID.

Parameter	Description	
Attributes (Page 49)	The attributes influence the following properties: • Input mode • Access level • Alignment of short text • Font size • Limits • Response when dialog is opened in terms of CHANGE block The attributes are separated by commas and appear in any order. The attributes are not valid for toggle fields. A definition can be made for each component.	
	Input mode	wr0: IO field invisible, short text visible wr1: Read (no focus possible for input) wr2: Read and write (line appears in white) wr3: wr1 with focus wr4: All variable elements invisible, no focus possible wr5: The value entered is saved immediately on every keystroke (in contrast to wr2, where it is only saved when the field is exited or RETURN is pressed). Default setting: wr2
	Access level	Empty: Can always be written ac0...ac7: Protection levels If the access level is not adequate, then the first line is displayed in gray, default setting: ac7
	Alignment of short text	al0: Left-justified al1: Right-justified al2: centered Default setting: al0
	Font size	fs1: Default font size (8 pt.) fs2: Double font size Default setting: fs1 The clearances between the lines is defined. With the default font size, 16 lines will fit into the dialog. Graphics and unit text can only be configured in the default font size.
	Limits	Consequently, it is possible to check whether the values of the variable are within the MIN and MAX limits specified. Default setting: Determined by specified limits li0: No check li1: Check with respect to min. li2: Check with respect to max. li3: Check with respect to min. and max.
	Behavior when opening	cb attributes specified for a variable in a variables definition take priority over the cb default setting in the dialog definition. Multiple attributes are separated by commas.

Parameter	Description	
	cb0:	The CHANGE block defined for this variable is edited when the dialog is opened (default setting). Multiple attributes are separated by commas.
	cb1:	The CHANGE block defined for this variable is then only processed if the value of the variable changes.
Help display (Page 47)	Help display file:	Name of the png file Default setting: Empty
	The name of the Help display file appears in double quotation marks. The display appears automatically (instead of the previous graphic) if the cursor is positioned on this variable.	
System or user variable (Page 50)	System or user data from the NC/PLC can be assigned to the variable. The system or user variable appears in double quotation marks. Reference: List Manual System Variables, /PGAsl/	
Position of short text (Page 62)	Position of short text (distance from left, distance from top, width) The positions are entered in pixels and relate to the upper left-hand corner of the main body of the dialog. The entries are separated by commas.	
Position of input/output field (Page 62)	Position of input/output field (distance from left, distance from top, width, height) The positions are entered in pixels and relate to the upper left-hand corner of the main body of the dialog. The entries are separated by commas. If this position changes, the positions of the short text, graphic text and unit text also change.	
Colors (Page 47)	Foreground color, background color: The colors are separated by a comma. Color settings are only relevant to the input/output field; colors cannot be specified for the other texts. Range of values: 1...10 Default setting: Foreground color: Black, background color: white The default colors of the input/output field are determined by the Write mode: "wr" indicates write mode.	

3.8 Details on the variable type

Variable type INTEGER

The following extensions for determining the display in the input/output field and the memory utilization are possible for the "INTEGER" type:

2nd character in the extension data type

Display format	
B	Binary
D	Decimal signed
H	hexadecimal
No data	Decimal signed

3rd and/or 4th character in the extension data type

Memory utilization	
B	Byte
W	Word
D	Double Word
BU	Byte, Unsigned
WU	Word, Unsigned
DU	Double word, Unsigned

Sequence of characters in the INTEGER data type

1. "I" Basic INTEGER designation
2. Display format
3. Memory utilization
4. "U" Unsigned

Valid INTEGER type specifications:	
IB	Integer variable 32 bits in binary notation
IBD	Integer variable 32 bits in binary notation
IBW	Integer variable 16 bits in binary notation
IBB	Integer variable 8 bits in binary notation
I	Integer variable 32 bits in decimal notation signed
IDD	Integer variable 32 bits in decimal notation signed
IDW	Integer variable 16 bits in decimal notation signed
IDB	Integer variable 8 bits in decimal notation signed
IDDU	Integer variable 32 bits in decimal notation unsigned
IDWU	Integer variable 16 bits in decimal notation unsigned
IDBU	Integer variable 8 bits in decimal notation unsigned
IH	Integer variable 32 bits in hexadecimal notation
IHDU	Integer variable 32 bits in hexadecimal notation
IHWU	Integer variable 16 bits in hexadecimal notation
IHBU	Integer variable 8 bits in hexadecimal notation

VARIANT variable type

The VARIANT variable type is determined by the data type of the last value assignment. It can be scanned using the ISNUM or ISSTR functions. The VARIANT type is mainly suited to the purpose of writing either variable names or numerical values to the NC code.

Programming

The data type of variables can be checked:

Syntax: **ISNUM** *(VAR)*
Parameters: VAR Name of the variable whose data type is to be checked.
The result of the scan can be:
FALSE =not a numerical variable (data type = STRING)
TRUE =numerical variable (data type = REAL)

Syntax: **ISSTR** *(VAR)*
Parameters: VAR Name of the variable whose data type is to be checked.
The result of the scan can be:
FALSE =numerical variable (data type = REAL)
TRUE =not a numerical variable (data type = STRING)
Example:

```
IF ISNUM(VAR1) == TRUE
IF ISSTR(REG[4]+2) == TRUE
```

The display mode of variables can be changed:

- For INTEGER, the display type can be changed.

B Binary
D Decimal signed
H hexadecimal
unsigned
With the addition of U for Unsigned

- For REAL data types, only the number of places after the decimal point can be changed.

  Changing the type is illegal and generates an error message in the easyscreen_log.txt. file.

  Example:

```
Var1.typ = "IBW"

Var2.typ = "R3"
```

Numerical formats

Numbers can be represented in either binary, decimal, hexadecimal or exponential notation:

Binary	B01110110
decimal	123.45
hexadecimal	HF1A9
exponential	-1.23EX-3

Examples:

```
VAR1 = HF1A9
REG[0]= B01110110
DEF VAR7 = (R//-1.23EX-3)
```

Note

When codes are generated with the "GC" function, only numerical values in decimal or exponential notation are evaluated, but **not** those in binary or hexadecimal notation.

See also

Variable parameters (Page 52)

3.9 Details on the toggle field

Description

The toggle field extension function can be used to display texts (entries in toggle field) as a function of NC/PLC variables. A variable, which makes use of a toggle field extension, is read-only.

Programming

Syntax: **DEF identifier =(variable type /+ $text number | * value="\\image"[,value="\\image2.png"][, ...]**
/[Default]
/[Texts(Long text, Short text, Graphic text, Units text)]
/[Attributes]
/[Help display]
/[System or user variable]
/[Position of short text]
/[Position input/output field(Left, Top, Width, Height)]
/[Colors]

Description: When the dialog is opened, the content of text number $85015 is displayed in the IO field. Default value 15 is entered in system variable DB90.DBB5. If the value saved in system variable DB90.DBB5 changes, the displayed text number $(85000 + <DB90.DBB5>) is recalculated in response to every change.

Parameters:

Variable type	Type of variables specified in the system or user variable
Text number	Number (basis) of the language-specific text valid as the basis number.
System or user variable	System or user variable (offset) via which the final text number (basis + offset) is displayed.

Example:
```
DEF VAR1=(IB/+ $85000/15////"DB90.DBB5")
```

Variable toggle field

It is possible to assign a variable toggle field to a dialog element, i.e., when the toggle key is pressed, a value configured in a CHANGE method is assigned to the variable.

An asterisk * is entered in the Limits or Toggle Field property to identify a variable toggle field when a variable is defined.

Example: `DEF VAR1=(S/*)`

Toggle-field-dependent displays

The toggle field is overlaid with graphics, which change depending on the value of the memory byte. If the value of the memory byte is 1, "image1.png" will appear. If it is 2, "image2.png" will appear.

```
DEF VAR1=(IDB/*1="\\image1.png",

              2="\\image2.png"//,$85000/wr1//"MB[0]"//160,40,50,50)
```

The size and position of the image is defined under "Position of IO field (left, top, width, height)".

See also

Variable parameters (Page 52)

3.10 Details on the default setting

Overview

A variable can assume various states depending on whether a default value, or a system or user variable, or both, has been assigned to the variable field (I/O field or toggle field). (Not calculated: Toggling is not possible until a valid value is assigned to the variable).

Scope of the default settings

If...			Then...
Field type	Default setting	System or user variable	Reaction of field type
I/O field	yes	yes	Write default value to system or user variable
	No	yes	Use system or user variable as default value
	Error	yes	Not calculated, system or user variable is not written into/used.
	yes	No	Default setting
	No	No	Not calculated
	Error	No	Not calculated
	yes	Error	Not calculated
	No	Error	Not calculated
	Error	Error	Not calculated
Toggle	yes	yes	Write default value to system or user variable
	No	yes	Use system or user variable as default value
	Error	yes	Not calculated, system or user variable not written/used
	yes	No	Default setting
	No	No	Default = first toggle field element
	Error	No	Not calculated
	yes	Error	Not calculated
	No	Error	Not calculated
	Error	Error	Not calculated

See also

Variable parameters (Page 52)

3.11 Details on the position of the short text, position of the input/output field

Overview

The short text and graphic text, as well as the input/output field and unit text, are each treated like a unit, i.e., position settings for short text apply to the graphic text and settings for the input/output field and to unit text.

Programming

The configured position entry overwrites the default value, i.e., only one value can be changed. If no position settings have been configured for subsequent screen form elements, then the position settings for the preceding screen form element are applied.

If no positions have been specified for any dialog elements, the default setting is applied. By default, the column width for the short text and input/output field is calculated for each line based on the number of columns and maximum line width, i.e.,column width = maximum line width/number of columns.

The width of the graphics and unit text is predefined and optimized to suit the requirements of programming support. If graphics or unit text has been configured, the width of the short text or I/O field is reduced accordingly.

The order of short text and I/O field can be reversed by position settings.

See also

Variable parameters (Page 52)

3.12 Use of strings

Strings

Strings can be used as part of the configuration. These allow text to be displayed dynamically or different texts to be chained for the purpose of code generation.

Rules

The following rules must be observed with regard to string variables:

- Logic operations are processed from left to right.
- Nested expressions are solved from the inside outwards.
- No distinction is made between uppercase and lowercase type.
- String variables are generally displayed left justified.

Strings can be deleted simply by assigning a blank string.

Strings can be appended after the equality sign using the operator "<<". Quotation marks (") in the string are represented by two successive quotation mark symbols. Strings can be checked for equality in IF instructions.

Example

Default settings for the following examples:

```
VAR1.VAL = "This is an"

VAR8.VAL = 4

VAR14.VAL = 15

VAR2.VAL = "Error"

$85001 = "This is an"

$85002 = "Alarm text"
```

Editing strings:

- Chaining of strings:

```
VAR12.VAL = VAR1 << " Error."   ;Result: "This is an error"
```

- Deleting a variable:

```
VAR10.VAL = ""   ;Result: Blank string
```

- Setting a variable with a text variable:

```
VAR11.VAL = VAR1.VAL   ;Result: "This is an"
```

- Data type matching:

```
VAR13.VAL ="This is the " << (VAR14 - VAR8) << ". error"

            ;Result: "This is the 11th error"
```

- Treatment of numerical values:

```
VAR13.VAL = "Error" << VAR14.VAL << ": " << $85001 << $85002

         ;Result: "Error 15: "This is an alarm text"

IF VAR15 == "Error"   ;Strings in IF statement

  VAR16 = 18.1234

         ;Result: VAR16 equals 18.1234,

         ;if VAR15 equals "Error".

ENDIF
```

- Quotation marks within a string:

```
VAR2="Hello, this is a " Test""

   ;Result: Hello, this is a " Test"
```

- System or user-variable strings dependent on variable content:

```
VAR2.Var = "$R[" << VAR8 << "]"   ;Result: $R[4]
```

See also

STRING functions (Page 130)

3.13 CURPOS variable

Description

Using the CURPOS variable, it is possible to display or manipulate the position of the cursor in the active input field of the current dialog. The variable indicates how many characters are located in front of the cursor. If the cursor is located at the start of the input field, then CURPOS assumes the value of 0. If the value of CURPOS is changed, then the cursor is positioned at the appropriate location in the input field.

In order to be able to respond to changes in the variable value, it is possible to monitor for changes using a CHANGE block. If the value of CURPOS changes, then a jump is made to the CHANGE block and the instructions contained there are executed.

3.14 CURVER variable

Description

The CURVER (CURrent VERsion) property allows the programming to be adapted in order to handle different versions. The CURVER variable is read-only.

Note

Even if previously recompiled with an older version, the code is automatically generated with the most recent version. The "GC" command always generates the most recent version. An additional identifier indicating the generated version is inserted in the user comment of the generated code in versions > 0.

Rules

The most recent dialog with all its variables is always displayed.

- Variables used previously may not be changed.
- New variables are inserted in the existing (cycle) programming in arbitrary order.
- It is not permissible to delete variables from a dialog from one version to the next.
- The dialog must contain all variables of all versions.

Example

```
(IF CURVER==1 ...)                ; When the code is recompiled, CURVER is
                                    automatically assigned the version of the
                                    recompiled code.
```

3.15 ENTRY variable

Description

The ENTRY variable can be used to check by what method a dialog has been called.

Programming

Syntax: **ENTRY**

Description: The ENTRY variable is a read only variable.

Return Value: The result of the scan can be:

- 0 =No programming support
- 1 =Programming support (the dialog was called by programming support)
- 2 =Programming support + default setting from the previous dialog (sub-dialog)
- 3 =Programming support + recompilation
- 4 =Programming support + recompilation with generated comments, with # sign
- 5 =Programming support + recompilation with generated comments, without # sign

Example

```
IF ENTRY == 0
  DLGL("The dialog was not called during programming")
ELSE
  DLGL("The dialog was called during programming")
ENDIF
```

3.16 ERR variable

Description

Variable ERR can be used to check whether the preceding lines have been executed correctly.

Programming

Syntax:	**ERR**
Description:	The ERR variable is read-only.
Return Value:	The result of the scan can be: FALSE =previous line was executed error-free TRUE =previous line was not executed error-free

Example

```
VAR4 = Thread[VAR1,"CDM",3]        ;   Output value from array
IF ERR == TRUE                     ;   Scan to check whether value has been found
                                       in array
  VAR5 = "Error accessing array"
                                   ;   If the value has not been found in the
                                       array, the value "Error accessing array" is
                                       assigned to the variables.
ELSE
  VAR5 = "All OK"                  ;   ;If the value has been found in the array,
                                       the value "All OK" is assigned to the
                                       variables.
ENDIF
```

3.17 FILE_ERR variable

Description

Variable FILE_ERR can be used to check whether the preceding GC or CP command has been executed correctly.

Programming

Syntax: **FILE_ERR**

Description: The FILE_ERR variable is read-only.

Return Value: Possible results are:

0 =Operation okay
1 =Drive/path not available
2 =Path/file access error
3 =Drive not ready
4 =Incorrect file name
5 =File is already open
6 =Access denied
7 =Target path not available or not permitted
8 =Copy source same as target
10 =Internal error: FILE_ERR = 10 means that the error cannot be classified in the other categories.

Example

```
CP("D:\source.mpf","E:\target.mpf")
                                    ;  Copy from source.mpf to E:\target.mpf
IF FILE_ERR > 0                     ;  Scan to ascertain whether error has occurred
   IF FILE_ERR == 1                 ;  Scan specific error numbers and output
                                       associated error text
      VAR5 = "Drive/path not available"
   ELSE
      IF FILE_ERR == 2
         VAR5 = "Path/file access error"
      ELSE
         IF FILE_ERR == 3
            VAR5 = "Wrong file name"
         ENDIF
      ENDIF
   ENDIF
ELSE
   VAR5 = "All OK"                  ;  If no errors have occurred in CP (or GC),
                                       "All OK" is output
ENDIF
```

3.18 FOC variable

Description

The FOC variable can be used to control the input focus (the current active input/output field) in a dialog. Responses to cursor left, right, up and down movements, as well as PGUP, PGDN, are predefined and cannot be modified.

Note

The FOC function may not be initiated as a result of a navigation event. The cursor position may only be changed in softkey PRESS blocks, CHANGE blocks, etc.

The FOC function cannot be applied to variables with input mode wr = 0 and wr = 4 or to Help variables.

Programming

Syntax:	**FOC**	
Description:	The variable can be read and written.	
Return Value:	Read	The result is the name of the variable to which the FOC function has been applied.
	Write	It is possible to assign either a string or a numerical value.A string is interpreted as a variable name and a numerical value as a variable index.

Example

```
IF FOC == "Var1"                ;  Read focus
  REG[1] = Var1
ELSE
  REG[1] = Var2
ENDIF

FOC = "Var1"                    ;  The input focus will be assigned to Variable 1.
FOC = 3                         ;  The input focus will be assigned to the 3rd
                                   dialog element with WR ≥ 2.
```

3.19 S_CHAN variable

Description

The S_CHAN variable can be used to determine the number of the current channel for display or evaluation purposes.

Programming commands

4

4.1 Operators

Overview

The following operators can be used when programming:

- Mathematical operators
- Relational operators
- Logic (Boolean) operators
- Bit operators
- Trigonometric functions

4.1.1 Mathematical operators

Overview

Mathematical operators	Identifier
+	Addition
-	Subtraction
*	Multiplication
/	Division
MOD	Modulo operation
( )	Parentheses
AND	AND operator
OR	OR operator
NOT	NOT operator
ROUND	Round off numbers with decimal places

Example: `VAR1.VAL = 45 * (4 + 3)`

ROUND

The ROUND operator is used to round off numbers with up to 12 decimal places during execution of a dialog configuration. The variable fields cannot accept the decimal places in the display.

Use

ROUND is controlled by the user with two parameters:

```
VAR1 = 5,2328543

VAR2 = ROUND( VAR1, 4 )
```

Result: `VAR2 = 5,2339`

VAR1 contains the number to be rounded. The parameter “4” indicates the number of decimal places in the result, which is placed in VAR2.

Trigonometric functions

Trigonometric functions	Identifier
SIN(x)	Sine of x
COS(x)	Cosine of x
TAN(x)	Tangent of x
ATAN(x, y)	Arc tangent of x/y
SQRT(x)	Square root of x
ABS(x)	Absolute value of x
SDEG(x)	Conversion to degrees
SRAD(x)	Conversion to radian

Note

The functions operate with radian measure. The functions SDEG() and SRAD() can be used for conversion.

Example: `VAR1.VAL = SQRT(2)`

Constants

Constants	
PI	3.14159265358979323846
FALSE	0
TRUE	1

Example: `VAR1.VAL = PI`

Relational operators

Relational operators	
==	Equal to
<>	Not equal to
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to

Example

```
IF VAR1.VAL == 1

  VAR2.VAL = TRUE

ENDIF
```

Conditions

The nesting depth is unlimited.

Condition with a command:

```
IF
...
ENDIF
```

Condition with two commands:

```
IF
...
ELSE
...
ENDIF
```

4.1.2 Bit operators

Overview

Bit operators	Identifier
BOR	Bit-serial OR
BXOR	Bit-serial XOR
BAND	Bit-serial AND
BNOT	Bit-serial NOT
SHL	Shift bits to left
SHR	Shift bits to right

SHL operator

Bits are shifted to the left using the SHL (SHIFT LEFT) operator. You can specify both the value to be shifted and the number of shift increments directly or via a variable. If the limit of the data format is reached, the bits are shifted beyond the limit without displaying an error message.

Use

Syntax:	variable = *value* **SHL***increment*	
Description:	Shift Left	
Parameters:	value	value to be shifted
	increment	number of shift increments

Example

```
PRESS(VS1)
  VAR01 = 16 SHL 2              ;  Result = 64
  VAR02 = VAR02 SHL VAR04       ;  Convert content of VAR02 to 32-bit unsigned , and
                                   shift content to left by number of bits specified
                                   in VAR04. Then convert 32-bit value back to
                                   format of variable VAR02.

END_PRESS
```

SHR operator

Bits are shifted to the RIGHT using the SHR (SHIFT RIGHT) function. You can specify both the value to be shifted and the number of shift increments directly or via a variable. If the limit of the data format is reached, the bits are shifted beyond the limit without displaying an error message.

Use

Syntax:	variable = *value* **SHR***increment*	
Description:	Shift Right	
Parameters:	value	value to be shifted
	increment	number of shift increments

Example

```
PRESS(VS1)
  VAR01 = 16 SHR 2                ;  Result = 4
  VAR02 = VAR02 SHR VAR04         ;  Convert content of VAR02 to 32-bit unsigned ,
                                     and shift content to left by number of bits
                                     specified in VAR04. Then convert 32-bit value
                                     back to format of variable VAR02.

END_PRESS
```

4.2 Methods

Overview

Various types of event (exit input field, actuate softkey) can initiate specific actions in dialogs and dialog-dependent softkey menus (softkey menus that are called from a newly configured dialog). These actions are configured in methods.

The following table shows the basic principle used to program a method:

Definition block	Comment	Chapter reference
`PRESS(HS1)`	;Method start identifier	
`LM...` `  LS...`	;Functions	See chapter "Functions"
`Var1.st = ...`	;Changing properties	see chapter "Softkey menu" and chapter "Dialog elements"

`Var2 = Var3 + Var4`
`...`
`EXIT`
	;Calculation with variables	See chapter "Defining variables"

`END_PRESS`	;Method end identifier	

4.2.1 CHANGE

Description

CHANGE methods are executed if a variable value changes, i.e., variable calculations that are performed as soon as a variable value changes are configured within a CHANGE method.

There are two types of CHANGE method, i.e., element-specific and global:

- The **element-specific CHANGE method** is executed if the value of a specified variable changes. If a system or user variable is assigned to a variable, cyclic updating of the variable value can be configured in a CHANGE method.
- The **global CHANGE method** is executed if the value of any variable changes and no element-specific CHANGE method has been configured.

"Element-specific" programming

Syntax:	CHANGE*(Identifier)* ... END_CHANGE
Description:	Changes the value of a specific variable
Parameters:	Identifier Name of the variable

Example

```
DEF VAR1=(I//////"DB20.DBB1")          ;  A system variable is assigned to Var1
CHANGE(VAR1)
  IF VAR1.Val <> 1
  VAR1.st="Tool OK!"                   ;  If the value of the system variable ≠ 1,
                                          the short text of the variable states:
                                          Tool OK!
    otto=1
  ELSE
    VAR1.st="Attention: Error!"        ;  If the value of the system variable = 1,
                                          the short text of the variable states:
                                          Attention: Error!
    otto=2
  ENDIF
  VAR2.Var=2
END_CHANGE
```

"Global" programming

Syntax:	CHANGE() ... END_CHANGE
Description:	Changes any variable value
Parameters:	- None -

Example

```
CHANGE()
  EXIT                        ;  If any of the variable values change, the dialog will
                                 be terminated.
END_CHANGE
```

4.2.2 FOCUS

Description

The FOCUS method is executed if the focus (cursor) is positioned on another field in the dialog.

The FOCUS method must not be initiated as a result of a navigation event. The cursor may only be moved in softkey PRESS blocks, CHANGE blocks, etc. Responses to cursor movements are are predefined and cannot be modified.

Note

Within the FOCUS block, it is not possible to select a different variable, nor can a new dialog be loaded.

Programming

Syntax:	FOCUS ... END_FOCUS
Description:	Positions the cursor
Parameters:	- None -

Example

```
FOCUS
  DLGL("The focus has been placed on variable" << FOC << ".)       °  °
END_FOCUS
```

4.2.3 LOAD

Description

The LOAD method is executed after the variable and softkey definitions (DEF Var1= ..., HS1= ...) have been interpreted. At this time, the dialog is not yet displayed.

Programming

Syntax:	LOAD ... END_LOAD
Description:	Download
Parameters:	- None -

Example

```
LOAD                                ; Start identifier
  Screen form1.Hd =  $85111         ; Assign text for dialog header from language
                                      file
  VAR1.Min = 0                      ; Assign MIN variable limit
  VAR1.Max = 1000                   ; Assign MAX variable limit
END_LOAD                            ; End code
```

See also

Line and rectangle (Page 137)

4.2.4 LOAD GRID

Description

The table description can be made available dynamically within the LOAD block using the LG method.

In order to assign a table using the LG method, the variable must have already been defined as a grid variable and cross-referenced to an existing, valid table.

Programming

Syntax:	LG *(Grid name, Variable name [,File name])*	
Description:	Loads a table	
Parameters:	Grid name	Name of the table (grid) in inverted commas
	Variable name	Name of the variable to which the table is to be assigned, in inverted commas
	File name	Name of the file in which the table (grid) is defined, in inverted commas. Only needs to be specified if the table is not defined within the file that also contains the definition of the variable

4.2.5 UNLOAD

Description

The UNLOAD method is executed before a dialog is unloaded.

Programming

Syntax:	UNLOAD ... END_UNLOAD
Description:	Unload
Parameters:	- None -

Example

```
UNLOAD
  REG[1] = VAR1                    ;  Save variable in register
END_UNLOAD
```

4.2.6 OUTPUT

Description

The OUTPUT method is executed if the "GC" function is called.Variables and Help variables are configured as an NC code in an OUTPUT method. The individual elements in a code line are linked by means of blanks.

Note

The NC code can be generated in an extra file by means of file functions and transferred to the NC.

Programming

Syntax:	OUTPUT *(Identifier)* ... END_OUTPUT
Description:	Outputs variables in the NC program.
Parameters:	Identifier Name of OUTPUT method

Block numbers and skip identifiers

The OUTPUT block must not contain line numbers or skip identifiers if you wish to keep the line numbers and hide markings directly set with active program support in the parts program in case of recompilations.

Editor changes in the parts program produce the following response:

Condition	Response
Number of blocks remains unchanged.	Block numbers are retained.
Number of blocks is reduced.	The highest block numbers are canceled.
Number of blocks is increased.	New blocks are not numbered.

Example

```
OUTPUT(CODE1)
  "CYCLE82(" Var1.val "," Var2.val "," Var3.val ","Var4.val "," Var5.val
"," Var6.val ")"
END_OUTPUT
```

4.2.7 PRESS

Description

The PRESS method is executed when the corresponding softkey is pressed.

Programming

Syntax:	PRESS*(softkey)*		
	...		
	END_PRESS		
Identifiers:	Pressing a softkey		
Parameters:	Softkey	Name of softkey: HS1 - HS8 and VS1 - VS8	
	RECALL	<RECALL> key	
	PU	Page Up	Screen up
	PD	Page Down	Screen down
	SL	Scroll left	Cursor left
	SR	Scroll right	Cursor right
	SU	Scroll up	Cursor up
	SD	Scroll down	Cursor down

Example

```
HS1 = ("another softkey menu")
HS2=("no function")
PRESS(HS1)
  LS("Menu1")                                ;  load another softkey menu
  Var2 = Var3 + Var1
END_PRESS
PRESS (HS2)
END_PRESS
PRESS(PU)
  INDEX = INDEX -7
  CALL("UP1")
END_PRESS
```

4.2.8 Example Version management with OUTPUT blocks

Overview

Additional variables can be added to existing dialogs when expanding the user interface. A version identifier in parentheses is appended to the additional variables in the definition following the variable name: (0 = Original, is not written), 1 = Version 1, 2 = Version 2, etc.

Example

```
DEF var100=(R//1)              ;  Original, corresponds to Version 0
DEF var101(1)=(S//"Hello")     ;  Expansion with effect from Version 1
```

When writing the OUTPUT block, you can specify which variables are written, with reference to a particular version identifier.

Example

```
OUTPUT(NC1)                    ;  Only the variables of the original version are
                                  made available in the OUTPUT block.
OUTPUT(NC1,1)                  ;  The variables of the original version and the
                                  expansions with version identifier 1 are made
                                  available in the OUTPUT block
```

The OUTPUT block for the original version does not need a version identifier, however you can specify it with 0. OUTPUT(NC1) is equivalent to OUTPUT(NC1,0). Version identifier n in the OUTPUT block includes all variables of the originals 0, 1, 2, ... up to and including n.

Programming with version identifier

```
//M(XXX)                          ;  Version 0 (default)
DEF var100=(R//1)
DEF var101=(S//"Hello")
DEF TMP
VS8=("GC")
PRESS(VS8)
   GC("NC1")
END_PRESS

OUTPUT(NC1)
var100",,"var101
END_OUTPUT

; ************ Version 1, extended definition ***************
//M(XXX)
DEF var100=(R//1)
DEF var101=(S//"Hello")
DEF var102(1)=(V//"HUGO")
DEF TMP
VS8=("GC")
PRESS(VS8)
   GC("NC1")
END_PRESS
...

OUTPUT(NC1)                       ;  Original and the new version in addition
var100","var101
END_OUTPUT
...

OUTPUT(NC1,1)                     ;  Version 1
var100","var101"," var102
END_OUTPUT
```

4.3 Functions

Overview

A variety of functions are available in dialogs and dialog-dependent softkey menus. These can be activated by specific events (exit input field, actuate softkey) and configured in methods.

Subroutines

Repeatedly used configuring instructions or others, which define the process for a particular operation can be configured in subprograms. Subprograms can be loaded into the main program or other subprograms at any time and executed as often as necessary, i.e., the instructions they contain do not need to be configured repeatedly. The definition blocks of the dialogs/softkey menu constitute a main program.

External functions

Additional, user-specific functions can be integrated by means of external functions. The external functions are stored in a DLL file and identified by an entry in the definition lines of the configuration file.

PI services

The PI_SERVICE function can be used to start PI Services (Program Invocation Services) from the PLC in the NC area.

See also

Function (FCT) (Page 104)

PI services (Page 134)

4.3.1 Define block (//B)

Description

In the program file, subprograms are identified by the block identifier //B and terminated with //END. Several subprograms can be defined under each block identifier.

Note

The variables used in the subprogram must be defined in the dialog in which the subprogram is called.

Programming

A block is structured in the following way:

Syntax:	**//B**(*Block name*) **SUB***(Identifier)* END_SUB [SUB(*Identifier*) ... END_SUB] ... //END	
Description:	Defines a subprogram	
Parameters:	Block name	Name of block identifier
	Identifier	Name of subprogram

Example

```
//B(PROG1)                          ;  Block start
SUB(UP1)                            ;  Start of subprogram
  ...
  REG[0] = 5                        ;  Assign value 5 to register 0
  ...
END_SUB                             ;  End of subprogram
SUB(UP2)                            ;  Start of subprogram
  IF VAR1.val=="Otto"
    VAR1.val="Hans"
    RETURN
  ENDIF
  VAR1.val="Otto"
END_SUB                             ;  End of subprogram
//END                               ;  Block end
```

4.3.2 Subprogram call (CALL)

Description

The CALL function can be used to call a loaded subprogram from any point in a method. Subprogram nesting is supported, i.e., you can call a subprogram from another subprogram.

Programming

Syntax:	CALL*("Identifier")*	
Description:	Subroutine call	
Parameters:	Identifier	Name of subprogram

Example

```
//M(SCREEN FORM1)
VAR1 = ...
VAR2 = ...
LOAD
  ...
  LB("PROG1")                          ;   Load block
  ...
END_LOAD
CHANGE()
  ...
  CALL("UP1")                          ;   Call subroutine and execute
  ...
END_CHANGE
...
//END
```

4.3.3 Check Variable (CVAR)

Description

You can use the CVAR (CheckVariable) function to run a scan to ascertain whether all or only certain variables or Help variables in a screen form are error-free.

It may be useful to check if variables contain a valid value before an NC code with the GC function.

A variable is error-free if the state of the variable Identifier.vld = 1.

Programming

Syntax:	**CVAR**(*VarN*)	
Description:	Checks variables for valid content	
Parameters:	VarN	List of variables to be checked. Up to 29 variables, each separated by a comma, can be checked. A character length of 500 must not be exceeded. The result of the scan can be: 1 =TRUE (all variables have valid content) 0 =FALSE (at least one variable has invalid content)

Example

```
IF CVAR == TRUE                ;   Check all variables
  VS8.SE = 1                   ;   If all variables are error-free, softkey VS8 is
                                   visible
ELSE
  VS8.SE = 2                   ;   If a variable has an invalid value, softkey VS8 is
                                   disabled
ENDIF


IF CVAR(”VAR1”, ”VAR2”) ==
TRUE
                               ;   Check variables VAR1 and VAR2
  DLGL ("VAR1 and VAR2 are
OK")
                               ;   If the values of VAR1 and VAR2 are error-free,
                                   "VAR1 and VAR2 are OK" appears in the dialog line
ELSE
  DLGL ("VAR1 and VAR2 are not OK")
                               ;   If the values of VAR1 and VAR2 are invalid, "VAR1
                                   and VAR2 are not OK" appears in the dialog line
ENDIF
```

4.3.4 Copy Program file function (CP)

Description

The CP (Copy Program) function copies files within the HMI file system or within the NC file system.

Programming

Syntax:	**CP***("Source file", "Target file")*	
Description:	Copies a file	
Parameters:	Source file	Complete path to the source file
	Target file	Complete path data of the target file

The return value can be used to query whether the function was successful:

```
CP("\MPF.DIR\CFI.MPF","\WKS.DIR\123.WPD\CFI.MPF",VAR1)
```

Example

Application with return value:

```
CP("//NC/MPF.DIR/HOHO.MPF","//NC/MPF.DIR/ASLAN.MPF",VAR3)
CP("//NC/MPF.DIR/hoho.MPF",VAR0,VAR3)
CP(VAR4,VAR0,VAR3)
CP("CF_CARD:/mpf.dir/myprog.mdf","//NC/MPF.DIR/HOHO.MPF",VAR3)
CP("//NC/MPF.DIR/HOHO.MPF",                          ; xyz must exist
"CF_CARD:/xyz/123.pmf",VAR3)
```

Application without return value:

```
CP("//NC/MPF.DIR/HOHO.MPF","//NC/MPF.DIR/ASLAN.MPF")
CP("//NC/MPF.DIR/hoho.MPF",VAR0)
CP(VAR4,VAR0)
CP("CF_CARD:/mpf.dir/myprog.mdf","//NC/MPF.DIR/HOHO.MPF")
CP("//NC/MPF.DIR/HOHO.MPF",                          ; xyz must exist
"CF_CARD:/xyz/123.mpf")
```

See also

Support of FILE_ERR: FILE_ERR variable (Page 69)

4.3.5 Delete Program file function (DP)

Description

The DP (Delete Program) function deletes a file from the passive HMI or active NC file system.

Programming

Syntax:	**DP***("File*")	
Description:	Delete file	
Parameters:	File	Complete path name of file to be deleted

Example

The following data management syntax is used for this function:

- with return value

```
DP("//NC/MPF.DIR/XYZ.DIR ", VAR1)
```

  VAR1 = 0 File was deleted.
  VAR1 = 1 File was not deleted.

- Without return value:

```
DP("//NC/MPF.DIR/XYZ.DIR ")
```

```
DP("\MPF.DIR\CFI.MPF")
```

4.3.6 Exist Program file function (EP)

Description

The EP (Exist Program) function checks whether a particular NC program is stored on the specified path in the NC or HMI file system.

Programming

Syntax:	**EP***("File"*)	
Description:	Checks the existence of the NC program	
Parameters:	File	Complete path to the file in the NC or HMI file system
Return Value:	Name of a variable to which the result of the scan should be assigned.	
	The result of the scan can be:	
	• M = File is stored on HMI	
	• N = file is stored on NC	
	• Blank string = The file neither exists on the HMI nor on the NC	

The EP function can handle the new syntax and the old logic (with adapted Syntax).

The file is directly addressed using a qualifying name:

```
//NC/MPF.DIR/XYZ.DIR
```

or

```
CF_CARD: /MPF.DIR/XYZ.DIR
```

or

```
LOC: /MPF.DIR/XYZ.DIR
```

New syntax:

```
EP("//NC/MPF.DIR/XYZ.DIR ", VAR1)
EP("CF_CARD:/MPF.DIR/XYZ.DIR ", VAR1)
EP("LOC:/MPF.DIR/XYZ.DIR ", VAR1)
;with return value:
; VAR1 = 0          File exists.
; VAR1 = 1          File does not exist.
```

Old syntax:

```
EP("/MPF.DIR/CFI.MPF", VAR1)
;with return value:
; VAR1 = M          File is located in the HMI file system.
; VAR1 = N          File is located in the NC file system.
; VAR1 = B          File is located in the HMI and NC file system.
```

Example

```
EP("\MPF.DIR\CFI.MPF", VAR1)          ;    Check whether file CFI.MPF exists in the
                                           HMI file system.
IF VAR1 == "M"
  DLGL("File is located in the HMI file system")
ELSE
  IF VAR1 == "N"
    DLGL("File is located in the NC file directory")
  ELSE
    DLGL("File is located neither in the HMI nor in the NC file
directory")
  ENDIF
ENDIF
```

4.3.7 Move Program file function (MP)

Description

The MP (Move Program) function copies files within the HMI file system or within the NC file system.

Programming

Syntax:	**MP***("source", "target")* `MP("CF_CARD:/MPF.DIR/MYPROG.MPF","//NC/MPF.DIR")`	
Description:	Move file	
Parameters:	Source file	Complete path data
	Target file	Complete path data

Examples

```
MP("//NC/MPF.DIR/123.MPF","//NC/MPF.DIR/ASLAN.MPF",VAR3)              // full paths
MP("//NC/MPF.DIR/123.MPF","//NC/MPF.DIR",VAR3)                        // target without file names
MP("//NC/MPF.DIR/123.MPF",VAR0,VAR3)                                  // target via variable
MP(VAR4,VAR0,VAR3)                                  // source and target via variable
MP("CF_CARD:/mpf.dir/myprog.mdf","//NC/MPF.DIR/123.MPF",VAR3)         // from CF card in NC
MP("//NC/MPF.DIR/HOHO.MPF","CF_CARD:/xyz/123.mpf",VAR3)               // from NC in CF card
MP("USB:/mpf.dir/myprog.mdf","//NC/MPF.DIR",VAR3)//                   // from USB to NC
```

4.3.8 Select Program file function (SP)

Description

The SP (Select Program) function selects a file in the active NC file system for execution, i.e., the file must be loaded into the NC beforehand.

Programming

Syntax:	**SP***("File")*	
Identifiers:	Selecting a program	
Parameters:	"File"	Complete path name of NC file

Example

The following data management syntax is used for this function:

- with return value

```
SP("//NC/MPF.DIR/MYPROG.MPF", VAR1)
```

  VAR1 = 0 File was loaded.
  VAR1 = 1 File was not loaded without return value

- Without return value:

```
SP("//NC/MPF.DIR/MYPROG.MPF")
```

```
//M(TestGC/"Code generation:")
DEF VAR1 = (R//1)
DEF VAR2 = (R//2)
DEF D_NAME
LOAD
  VAR1 = 123
  VAR2 = -6
END_LOAD
OUTPUT(CODE1)
  "Cycle123(" VAR1 "," VAR2 ")"
  "M30"
END_OUTPUT
PRESS(VS1)
  D_NAME = "CF_CARD:/MPF.DIR/MESSEN.MPF"
  GC("CODE1",D_NAME)            ;Write code from the OUTPUT method to file
                                CF_CARD:/MPF.DIR/MESSEN.MPF
END_PRESS
PRESS(HS8)
  MP("CF_CARD:/MPF.DIR/MESSEN.MPF","//NC/MPF.DIR")      ;Load file into NC
  SP("\MPF.DIR\MESSEN.MPF")                             ;Select file
END_PRESS
```

4.3.9 Dialog line (DLGL)

Description

It is possible to configure short texts (messages or input tips) for output in the dialog line of the dialog in response to certain situations.

Possible number of characters in the default font size: approx. 50

Programming

Syntax:	**DLGL***("String")*	
Description:	Outputs text in the dialog line	
Parameters:	String	Text, which is displayed in the dialog line

Example

```
IF Var1 > Var2
  DLGL("Value too large!")      ;  The text "Value too large!" appears in the dialog
                                   line if variable1 > variable2.
ENDIF
```

4.3.10 Evaluate (EVAL)

Description

The EVAL function evaluates a transferred expression and then executes it. With this function, expressions can be programmed during runtime. This can be useful, for example, for indexed access operations to variables.

Programming

Syntax:	**EVAL***(exp)*	
Description:	Evaluates an expression	
Parameters:	exp	Logic expression

Example

```
VAR1=(S)
VAR2=(S)
VAR3=(S)
VAR4=(S)
CHANGE()
  REG[7] = EVAL("VAR"<<REG[5])        ;  The expression in parentheses produces
                                         VAR3 if the value of REG[5] is equal to 3.
                                         The value of VAR3 is, therefore, assigned
                                         to REG[7].
  IF REG[5] == 1
    REG[7] = VAR1
  ELSE
    IF REG[5] == 2
      REG[7] = VAR2
    ELSE
      IF REG[5] == 3
        REG[7] = VAR3
      ELSE
        IF REG[5] == 4
          REG[7] = VAR4
        ENDIF
      ENDIF
    ENDIF
  ENDIF
END_CHANGE
```

4.3.11 Exit dialog (EXIT)

Description

The EXIT function is used to exit a dialog and return to the master dialog. If no master dialog is found, you will exit the newly configured user interfaces and return to the standard application.

Programming (without parameters)

Syntax:	**EXIT**
Description:	Exits a dialog
Parameters:	- None -

Example

```
PRESS(HS1)
  EXIT
END_PRESS
```

Description

If the current dialog has been called with a transfer variable, the value of the variables can be changed and transferred to the output dialog.

The variable values are each assigned to the variables transferred from the output dialog to the subsequent dialog using the "LM" function. Up to 20 variable values, each separated by a comma, can be transferred.

Note

The sequence of variables or variable values must be the same as the sequence of transfer values programmed for the LM function to preclude assignment errors. Any unspecified variable values will not be changed when the transfer is made. The modified transfer variables are immediately valid in the output dialog on execution of the LM function.

Programming with a transfer variable

Syntax:	**EXIT***[(VARx)]*	
Description:	Exits dialog and transfers one or more variables	
Parameters:	VARx	Label variables

Example

```
//M(Screen form1)
...
PRESS(HS1)
  LM("SCREEN FORM2","CFI.COM",1, POSX, POSY, DIAMETER)
                                ; Interrupt screen form1 and open screen form2.
                                  Transfer variables POSX, POSY and DIAMETER in
                                  doing this.
  DLGL("Screen form2 ended")    ; On returning from screen form2, the following
                                  text appears in the dialog line of screen form
                                  1: Screen form2 ended.
END_PRESS
...
//END

//M(Screen form2)
...
PRESS(HS1)
 EXIT(5, , CALCULATED_DIAMETER)
                                ; Exit screen form2 and return to screen form1 in
                                  the line after LM. In doing this, assign the
                                  value 5 to the variable POSX and the value of
                                  the CALCULATED_DIAMETER variable to the DIAMETER
                                  variable. The variable POSY retains its current
                                  value.
END_PRESS
...
//END
```

4.3.12 Exit Loading Softkey (EXITLS)

Description

You can use the EXITLS function to exit the current user interface and load a defined softkey menu.

Programming

Syntax:	**EXITLS***("Softkey menu"[, "Path"]*)	
Description:	Exits dialog and loads a softkey menu	
Parameters:	Softkey menu	Name of the softkey menu to be loaded
	Path name	Directory path of the softkey menu to be loaded

Example

```
PRESS(HS1)
    EXITLS( "Menu1", "AEDITOR.COM" )
END_PRESS
```

4.3.13 Function (FCT)

Description

The external functions are stored in a DLL file and identified by an entry in the definition lines of the configuration file.

Note

The external function must have at least one return parameter.

Programming

Syntax:	**FCT***Function name = ("File"/Type of return/Types of permanent parameters/Types of variable parameters)*	
	FCT InitConnection = ("c:\tmp\xyz.dll"/I/R,I,S/I,S)	
Description:	An external function can e.g. be called in the LOAD block or in the PRESS block.	
Parameters:	Function name	Name of external function
	File	Complete path to DLL file
	Type of return	Data type of the return value
	Type of fixed parameter	Value parameter
	Type of variable parameter	Reference parameter
	The data types are separated by commas.	

The external function can e.g. be called in the LOAD block or in the PRESS block.

Example:

```
press(vs4)

RET = InitConnection(VAR1,13,"Servus",VAR2,VAR17)

end_press
```

Structure of the external function

The external function must take into account a certain, specific signature:

Syntax:	external "C" dllexport void InitConnection (ExtFctStructPtr FctRet, ExtFctStructPtr FctPar, char cNrFctPar)	
Description:	DLL export, only when implemented in Windows	
	Specified and transfer parameters are strictly defined. The actual call parameters are transferred using the transferred structures.	
Parameters:	cNrFctPar	Number of call parameters = number of structure elements in FctPar
	FctPar	Pointer to a field of structure elements, which contain the particular call parameter with data type.
	FctRet	Pointer to a structure for the function value return with data type.

Definition of the transfer structure

```
union CFI_VARIANT
       (
       char                                b;
       short int                           i;
       double                              r;
       char*                               s;
       )
typedef struct ExtFctStructTag
       (
       char                                cTyp;
       union CFI_VARIANT                   value;
       )ExtFctStruct;
typedef struct ExtFct* ExtFctStructPtr;
```

If the external function is to be developed independently of the platform (Windows, Linux), then it is not permissible to use the keyword __declspec(dllexport). This keyword is only required under Windows. For instance, the following macro can be used under Qt.

```
#ifdef Q_WS_WIN
       #define MY_EXPORT __declspec(dllexport)
#else
       #define MY_EXPORT
#endif
```

The function is declared as follows:

```
extern "C" MY_EXPORT void InitConnection
(ExtFctStructPtr FctRet, ExtFctStructPtr FctPar,char cNrFctPar)
```

If the screens, configured with Easy Screen, are used on the NCU and PCU/PC, then the extension of the binary file must be omitted:

```
FCT InitConnection = ("xyz"/I/R,I,S/I,S)
```

When the absolute path information is omitted, Easy Screen first searches for the binary file in the proj directory.

4.3.14 Generate code (GC)

Description

The GC (Generate Code) function generates NC code from the OUTPUT method.

Programming

Syntax:	**GC**("*Identifier"[,"Target file"][,Opt],[Append])*	
Description:	Generate an NC code	
Parameters:	Identifier	Name of OUTPUT block from which code is generated
	Target file	Path name of target file for HMI or NC file system
		If the target file is not specified (only possible within programming support system), the code will be written to the location of the cursor within the file that is currently open.
	Opt	Option for generating comments
		0:(Default setting) Generate code with comment for the purpose of recompilability.
		1:Do not create comments in the generated code.
		Note: This code cannot be recompiled (see also Recompile without comment (Page 126)).
	Append	This parameter is only relevant if a target file is specified.
		0:(Default setting) If the file already exists, the old content is deleted.
		1:If the file already exists, the new code is written at the start of the file.
		2:If the file already exists, the new code is written at the end of the file.

Example

```
//M(TestGC/"Code generation:")
DEF VAR1 = (R//1)
DEF VAR2 = (R//2)
DEF D_NAME
LOAD
  VAR1 = 123
  VAR2 = -6
END_LOAD
OUTPUT(CODE1)
  "Cycle123(" VAR1 "," VAR2 ")"
  "M30"
END_OUTPUT

PRESS(VS1)
  D_NAME = "\MPF.DIR\MESSEN.MPF"
  GC("CODE1",D_NAME)                          ;Write code from OUTPUT method to file
                                              \MPF.DIR\MESSEN.MPF:
                                              Cycle123(123, -6)
                                              M30

END_PRESS
```

Recompile

- **No entry for target file:**

  The GC function can only be used in the Programming Support system and writes the NC code to the file currently open in the Editor. Recompilation of the NC code is possible. If the GC function is configured without a target file being specified under "Easy Screen", an error message is output when it is executed.

- **Entry for target file:**

  The code generated from the OUTPUT block is transferred to the target file. If the target file does not already exist, it is set up in the NC file system. If the target file is stored in the HMI file system, it is stored on the hard disk. User comment lines (information required to recompile code) are not set up, i.e. the code cannot be recompiled.

Special considerations for target file specification

In principle, there are two different ways of specifying a target file:

- **NC notation:** `/_N_MPF_DIR/_N_MY_FILE_MPF`

  The file is created in the MPF directory on the NC.

- **DOS notation:** `d:\abc\my_file.txt` or `\\RemoteRechner\files\my_file.txt`

  The file is written to the specified directory on the hard disk or on the specified PC, provided that the directory is available on the hard disk or on a remote PC.

Note

Invalid variables generate a blank string in generated NC code and an error message in the log book when they are read.

Special features of recompilation

The GC function cannot be called in sub-dialogs because variables originating from master dialogs can be used in sub-dialogs. These variables would not, however, be available in response to a direct call.

When generated code is processed manually with the Editor, the number of characters for values created by the code generation program must not be changed. Changing these values would make it impossible to recompile the code.

Remedy:

1. Recompile
2. Make change using the configured dialog. (e. g., 99 → 101)
3. GC

See also

Recompile (Page 124)

4.3.15 Load Array (LA)

Description

The LA (Load Array) function can be used to load an array from another file.

Programming

Syntax:	**LA***(Identifier [, File])*	
Description:	Loads array from file	
Parameters:	Identifier	Name of array to be loaded
	File	File in which the array is defined

Note

If an array in the current configuration file must be replaced by an array from another configuration file, then both arrays must have the same name.

Example

```
                                    ;  Extract from file   maske.com
DEF VAR2 = (S/*ARR5/"Out"/,"Toggle
field")
PRESS(HS5)
  LA("ARR5","arrayext.com")         ;  Load array ARR5 from file arrayext.com
  VAR2 = ARR5[0]                    ;  "Above"/"Below"/"Right"/"Left" appears in the
                                       VAR2 toggle field
                                       instead of "Out/In"
END_PRESS
//A(ARR5)
("Out"/"In")
//END
                                    ;  Extract from file arrayext.com
//A(ARR5)
("Above"/"Below"/"Right"/"Left"
)
//END
```

Note

Please note that a valid value must be assigned to a variable after the LA function has been used to assign another array to the toggle field of the variable.

4.3.16 Load Block (LB)

Description

The LB (Load Block) function can be used to load blocks containing subprograms during runtime. LB should be configured in a LOAD method so that the loaded subprograms can be called at any time.

Note

Subprograms can also be defined directly in a dialog so that they do not have to be loaded.

Programming

Syntax:	**LB***("Block name"[,"File"])*	
Description:	Loads subprogram during runtime	
Parameters:	Block name	Name of block identifier
	File	Path name of configuration file
		Default setting = Current configuration file

Example

```
LOAD
  LB("PROG1")                    ;  Block "PROG1" is searched for in the current
                                    configuration file and then loaded.
  LB("PROG2","XY.COM")           ;  Block "PROG2" is searched for in the
                                    configuration file XY.COM and then loaded.
END_LOAD
```

4.3.17 Load Mask (LM)

Description

The LM function can be used to load a new dialog.

Master dialog/Sub-dialog

A dialog, which calls another dialog, but is not ended itself, is referred to as a master dialog. A dialog that is called by a master dialog is referred to as a sub-dialog.

Programming

Syntax:	**LM***("Identifier"[,"File"] [,MSx [, VARx]])*	
Description:	Loads dialog	
Parameters:	Identifier	Name of the dialog to be loaded
	File	Path name (HMI file system or NC file system) of the configuration file, default setting: Current configuration file
	MSx	Mode of dialog change
		0:(Default setting) The current dialog disappears; the new dialog is loaded and displayed. EXIT will send you back to the standard application. You can use the MSx parameter to determine whether or not the current dialog should be terminated when changing dialogs. If the current dialog is retained, variables can be transferred to the new dialog.
		The advantage of the MSx parameter is that the dialogs do not always need to be reinitialized when they are changed; instead, the data and layout of the current dialog are retained and data transfer is made easier.
		1:The current master dialog is interrupted when the LM function is initiated; the new sub-dialog is loaded and displayed. EXIT will end the sub-dialog and return to the point at which the master dialog was interrupted.
		In the master dialog, the UNLOAD block is not processed during the interruption.
	VARx	Requirement: MS1
		List of variables, which can be transferred from the master dialog to the sub-dialog. Up to 20 variables, each separated by a comma, can be transferred.

Note

Parameter VARx transfers only the value of the variable in each case, i.e., variables can be read and written in the sub-dialog, but are not visible in it. Variables can be returned from the sub-dialog to the master dialog by means of the EXIT function.

Example

```
PRESS(HS1)
  LM("SCREEN FORM2","CFI.COM",1, POSX, POSY, DIAMETER)
                                ;  Interrupt screen form1 and open screen form2:
                                   Variables POSX, POSY and DIAMETER are transferred
                                   in doing this.
  DLGL("Screen form2 ended")    ;  On returning from screen form2, the following text
                                   appears in the dialog line of screen form 1:
                                   Screen form2 ended.
END_PRESS
```

4.3.18 Load Softkey (LS)

Description

The LS function can be used to display another softkey menu.

Programming

Syntax:	**LS***("Identifier"[, "File"][, Merge])*	
Description:	Displays softkey menu	
Parameters:	Identifier	Name of softkey menu
	File	Path (HMI file system or NC file system) to the configuration file Default: Current configuration file
	Merge	
		0:All existing softkeys are deleted; the newly configured softkeys are entered.
		1:Default Only the newly configured softkeys overwrite the available softkeys. The other softkeys (= softkeys of the HMI application) are kept with their functionality and text.

Example

```
PRESS(HS4)
  LS("Menu2",,0)                ;   Menu2 overwrites the existing softkey menu, the
                                    softkeys that are displayed are deleted.

END_PRESS
```

NOTICE

As long as the interpreter has not displayed a dialog, i.e., no LM function has yet been processed, only one LS or one LM command, but no other action, can be configured in the PRESS method of the definition block for the start softkey and the softkey menu.

The LS and LM functions may only be called within a softkey PRESS block and will not react if navigation keys are pressed (PU, PD, SL, SR, SU, SD).

4.3.19 Read NC/PLC (RNP), Write NC/PLC (WNP)

Description

The RNP (Read NC PLC) command can be used to read NC or PLC variables or machine data.

Programming

Syntax:	**RNP** ("*System or user variable", value*)	
Description:	Reads NC or PLC variable or machine data	
Parameters:	System or user variable	Name of NC or PLC variable
	Value	Value that is to be written to the system or user variable. If the value is a String type, it must be written in double quotation marks.

Example

```
VAR2=RNP("$AA_IN[2]")                    ;     Read NC variable
```

Description

The WNP (Write NC PLC) command can be used to write NC or PLC variables or machine data.

NC/PLC variables are accessed anew every time the WNP function is executed, i.e., NC/PLC access is always executed in a CHANGE method. It is advisable to use this option in cases where a system or user variable changes value frequently. If an NC/PLC variable is to be accessed only once, then it must be configured in a LOAD or UNLOAD method.

Programming

Syntax:	**WNP***("System or user variable", value)*	
Description:	Writes NC or PLC variable or machine data	
Parameters:	System or user variable	Name of NC or PLC variable
	Value	Value that is to be written to the system or user variable. If the value is a String type, it must be written in double quotation marks.

Example

```
WNP("DB20.DBB1",1)                    ;     Write PLC variable
```

4.3.20 Multiple Read NC PLC (MRNP)

Description

This MRNP command can be used to transfer several system or OPI variables in a single register access. This access method is significantly faster than reading via individual access attempts. The system or OPI variables must be included within an MRNP command of the same area.

The areas of the system or OPI variables are organized as follows:

- General NC data ($MN..., $SN.., /nck/...)
- Channel-specific NC data ($MC..., $SC.., /channel/...)
- PLC data (DB..., MB.., /plc/...)
- Axis-specific NC data on the same axis ($MA..., $SA..)

Programming

Syntax:	**MRNP***(Variable name 1*Variable name 2[* ...], Register index)*
Description:	Reads several variables
Parameters:	In the variable names, "*" is the separator. The values are transferred to register REG[Register index] and those following in the order that the variable names appear in the command. The following therefore applies: The value of the first variable is located in REG[Register index]. The value of the second variable is located in REG[Register index + 1], etc.

NOTICE
It should be noted that the number of registers is restricted and the list of variables cannot exceed 500 characters.

Example

```
MRNP("$R[0]*$R[1]*$R[2]*$R[3]",1)      ;The values of variables $R[0] to $R[3] are
                                        written to REG[1] to REG[4].
```

Reading display machine data:

Display machine data can be read with RNP ($MM...) within the LOAD block.

General read/write access to display machine data is not possible using the "Easy Screen" function.

Note

User variables may not have the same names as system or PLC variables.

NC variable

All machine data, setting data and R parameters are available, but only certain system variables (see also: List of accessible system variables (Page 173)).

All global and channel-specific user variables (GUDs) can be accessed. However, local and program-global user variables cannot be processed.

Machine data	
Global machine data	$MN_...
Axis-specific machine data	$MA_...
Channel-specific machine data	$MC_...

Setting data	
Global setting data	$SN_...
Axis-specific setting data	$SA_...
Channel-specific setting data	$SC_...

System variables	
R parameter 1	$R[1]

PLC variable

All PLC data are available.

PLC data	
Byte y bit z of data block x	DBx.DBXy.z
Byte y of data block x	DBx.DBBy
Word y of data block x	DBx.DBWy
Double word y v. of data block x	DBx.DBDy
Real y of data block x	DBx.DBRy
Flag byte x bit y	Mx.y
Flag byte x	MBx
Flag word x	MWx
Flag double word x	MDx
Input byte x bit y	Ix.y or Ex.y
Input byte x	IBx or EBx
Input word x	IWx or EWx
Input double word x	IDx or EDx
Output byte x bit y	Qx.y or Ax.y
Output byte x	QBx or ABx
Output word x	QWx or AWx
Output double word x	QDx or ADx
String y with length z from data block x	DBx.DBSy.z

4.3.21 Register (REG)

Register description

Registers are needed in order to exchange data between different dialogs. Registers are assigned to each dialog. These are created when the first dialog is loaded and assigned the value 0 or a blank string.

Note

Registers may not be used directly in OUTPUT blocks for generating NC code.

Programming

Syntax:	**REG***[x]*	
Description:	Defines register	
Parameters:	x	Register index with x = 0...19; Type: REAL or STRING = VARIANT Registers with x ≥ 20 have already been assigned by Siemens.

Description of register value

The assignment of values to registers is configured in a method.

Note

If a new dialog is generated from an existing dialog by means of the LM function, register content is automatically transferred to the new dialog at the same time and is available for further calculations in the second dialog.

Programming

Syntax:	*Identifier*.val = *Register value* or *Identifier* = *Register value*	
Description:		
Parameters:	Identifier	Name of register
	Register value	Value of register

Example

```
UNLOAD
  REG[0] = VAR1                    ;    Assign value of variable 1 to register 0
END_UNLOAD

UNLOAD
  REG[9].VAL = 84                  ;    Assign value 84 to register 9
END_UNLOAD
                                   ;    These registers can then be assigned to local
                                        variables again in a method in the next
                                        dialog.
LOAD
  VAR2 = REG[0]
END_LOAD
```

Description of register status

The Status property can be used to scan a register for valid content.

One possible use for the register scan function is to ensure that a value is written to a register only if the relevant dialog is a "master dialog".

Programming

Syntax:	*Identifier*.vld	
Description:	Status is a read-only property.	
Parameters:	Identifier	Name of register
Return Value:		The result of the scan can be:
		FALSE =invalid value
		TRUE =valid value

Example

```
IF REG[15].VLD == FALSE                ; Scan validity of register value
  REG[15] = 84
ENDIF
VAR1 = REG[9].VLD                      ; Assign the value of the REG[9] status
                                         request to Var1.
```

4.3.22 RETURN

Description

The RETURN function can be used to prematurely terminate execution of the current subprogram and to return to the branch point of the last CALL command.

If no RETURN command is configured in the subprogram, the subprogram will run to the end before returning to the branch point.

Programming

Syntax:	**RETURN**
Description:	Returns to the branch point
Parameters:	- None -

Example

```
//B(PROG1)                      ;  Block start
SUB(UP2)                        ;  Start of subprogram
  IF VAR1.val=="Otto"
    VAR1.val="Hans"
    RETURN                      ;  If the variable value = Otto, the value "Hans"
                                   is assigned to the variable, and the subprogram
                                   ends at this point.
  ENDIF
  VAR1.val="Otto"               ;  If the variable value ≠ Otto, the value "Otto"
                                   is assigned to the variable.
END_SUB                         ;  End of subroutine
//END                           ;  Block end
```

4.3.23 Recompile

Description

In the programming support system, it is possible to **recompile** NC code that has been generated with the GC function and to display the variable values in the input/output field of the associated entry dialog again.

Programming

Variables from the NC code are transferred to the dialog. At the same time, the variable values from the NC code are compared with the calculated variable values from the configuration file. If the values do not coincide, an error message is written to the log book because values have been changed during NC code generation.

If the NC code contains the same variable several times, it is evaluated at the point where it last occurs during recompilation. A warning is also written to the log book.

Variables not utilized in NC code during code generation are stored as user comment. The term "user comment" refers to all information required to recompile codes. User comment must not be altered.

Note

The block consisting of NC code and user comment can be recompiled only if it starts at the beginning of a line.

Examples:

The programm contains the following NC code:

```
DEF VAR1=(I//101)
OUTPUT(CODE1)
  "X" VAR1 " Y200"
  "X" VAR1 " Y0"
END_OUTPUT
```

The following code is then stored in the parts program:

```
;NCG#TestGC#\cus.dir\aeditor.com#CODE1#1#3#
X101 Y200
X101 Y0
;#END#
```

The Editor reads the following during recompilation:

```
X101 Y200
X222 Y0                 ;  The value for X has been changed in the parts program
                           (X101 → X222)
```

The following value is displayed for VAR1 in the input dialog: `VAR1 = 222`

See also

Generate code (GC) (Page 107)

4.3.24 Recompile without comment

Description

In the programming support system, it is possible to **recompile without comments** the NC code that has been generated with the GC function and to display the variable values in the input/output field of the associated entry dialog again.

Programming

The GC command can be executed in the following way in order to suppress comment lines that are generated for standard code generation:

```
GC("CODE1",D_NAME,1)
```

Normally, the resulting code cannot be recompiled. The following steps are required in order to be able to recompile the cycle calls generated in this way:

- **Expanding the easyscreen.ini**

  Section `[RECOMPILE_INFO_FILES]` will be introduced into the easyscreen.ini file. In this section, all ini files are listed that contain descriptions for cycles recompiled without comment:

```
 [RECOMPILE_INFO_FILES]
IniFile01 = cycles1.ini
IniFile02 = cycles2.ini
```

  Several ini files can be specified, whose names can be freely selected.

- **Creating an ini file for a cycle description**

  The ini file with the cycle descriptions is stored under /user or /oem in the directory /sinumerik/hmi/cfg. A separate section is required for each cycle. The section name corresponds to the name of the cycle:

```
[Cycle123]
Mname = TestGC
Dname = testgc.com
OUTPUT = Code1
Anzp = 3
Version = 0
Code_type = 1
Icon = cycle123.png
Desc_Text = This is describing text
```

Mname	Screen form name
Dname	Name of the file in which the screen is defined
OUTPUT	Name of the respective output block
Anzp	Number of parameters of the screen to be recompiled (all with DEF-created variables, also help variables)
Version	(optional) version specification for cycle
Icon	(optional) icon for display in the machining step program, format *.png Screen size for corresponding resolution: 640 X 480 mm → 16 x 16 pixels 800 X 600 mm → 20 x 20 pixels 1024 X 768 mm → 26 x 26 pixels 1280 X 1024 mm → 26 x 26 pixels 1280 X 768 mm → 26 x 26 pixels File loc.: /sinumerik/hmi/ico/ico<resolution> Note:For resolutions of 1280, the folder for 1024 x 768 mm used (only suitable for machining step programs).
Desc_Text	(optional) Explanation text for display in the machining step program, max. length of 17 character string (only suitable for machining step programs)

Example

```
//M(TestGC/"Code generation:")
DEF VAR1 = (R//1)
DEF VAR2 = (R//2)
DEF D_NAME
LOAD
  VAR1 = 123
  VAR2 = -6
END_LOAD
OUTPUT(CODE1)
  "Cycle123(" VAR1 "," VAR2 ")"
  "M30"
END_OUTPUT

PRESS(VS1)
  D_NAME = "\MPF.DIR\MESSEN.MPF"
  GC("CODE1",D_NAME)                    ;Write code from OUTPUT method to file
                                        \MPF.DIR\MESSEN.MPF:
                                        Cycle123(123, -6)
                                        M30

END_PRESS
```

See also

Generate code (GC) (Page 107)

4.3.25 Search Forward, Search Backward (SF, SB)

Description

The **SF, SB (Search Forward, Search Backward)** function is used to search for a string from the current cursor position in the NC program currently selected in the Editor and to output its value.

Programming

Syntax:	**SF***("String")*	
Identifiers:	**S**earch **F**orward: Search forward from the current cursor position	
Syntax:	**SB***("String")*	
Identifiers:	**S**earch **B**ackward: Search backward from the current cursor position	
Parameters:	String	Text to be found

Rules governing text search

- A blank must be inserted before and after the search concept unit, consisting of search string and its value, in the currently selected NC program.
- The system does not search for concepts within comment text or other strings.
- The value to be output must be a numerical expression. Expressions in the form of "X1=4+5" are not recognized.
- The system recognizes hexadecimal constants in the form of X1='HFFFF', binary constants in the form of X1='B10010' and exponential components in the form of X1='-.5EX-4'.
- The value of a string can be output if it contains the following between string and value:
  - Nothing
  - Blanks
  - Equality sign

Example

The following notations are possible:

```
X100 Y200                    ;   The variable Abc is assigned the value 200
Abc = SB("Y")
X100 Y 200                   ;   The variable Abc is assigned the value 200
Abc = SB("Y")
X100 Y=200                   ;   The variable Abc is assigned the value 200
Abc = SB("Y")
```

4.3.26 STRING functions

Overview

The following functions enable strings to be processed:

- Determine length of string
- Find a character in a string
- Extract substring from left
- Extract substring from right
- Extract substring from mid-string
- Replace substring

LEN function: Length of a string

Syntax:	**LEN***(string / varname)*	
Description:	Determines the number of characters in a string	
Parameters:	string	Every valid string expression. NULL is output if string is blank.
	varname	Any valid declared variable name
	Only one of the two parameters is allowed.	

Example

```
DEF VAR01
DEF VAR02

LOAD
  VAR01="HALLO"
  VAR02=LEN(VAR01)                    ;    Result = 5
END_LOAD
```

INSTR function: Search for character in string

Syntax:	**INSTR***(Start, String1, String2 [,Direction])*	
Description:	Searches for characters	
Parameters:	Start	Starting position for searching from string1 into string2. Enter 0 to start searching at the beginning of string2.
	String1	Character that is being searched for.
	String2	Chain of characters in which the search is being made
	Direction (optional)	Direction in which the search is being made 0: From left to right (default setting) 1: From right to left
	0 is returned if string1 does not occur in string2.	

Example

```
DEF VAR01
DEF VAR02

LOAD
  VAR01="HELLO/WORLD"
  VAR02=INST(1,"/",VAR01)              ;    Result = 6
END_LOAD
```

LEFT Function: String from left

Syntax:	**LEFT***(string, length)*	
Description:	LEFT returns a string containing the specified number of characters starting from the left-hand side of a string.	
Parameters:	string	Character string or variable with the string to be processed
	length	Number of characters that are to be read out

Example

```
DEF VAR01
DEF VAR02
LOAD
 VAR01="HELLO/WORLD"
  VAR02=LEFT(VAR01,5)                    ;  Result = "HELLO"
END_LOAD
```

RIGHT function: String from right

Syntax:	**RIGHT***(string, length)*	
Description:	RIGHT returns a string containing the specified number of characters starting from the right-hand side of a string.	
Parameters:	string	Character string or variable with the string to be processed
	length	Number of characters that are to be read out

Example

```
DEF VAR01
DEF VAR02
LOAD
 VAR01="HELLO/WORLD"
  VAR02=LEFT(VAR01,4)                    ;  Result = "WORLD"
END_LOAD
```

MIDS function: String from mid-string

Syntax:	**MIDS***(string, start [, length])*	
Description:	MIDS returns a string containing the specified number of characters starting at the specified position in the string.	
Parameters:	string	Character string or variable with the string to be processed
	start	Start from where characters are to be read in the string
	length	Number of characters that are to be read out

Example

```
DEF VAR01
DEF VAR02
LOAD
 VAR01="HELLO/WORLD"
  VAR02=LEFT(VAR01,4,4)                    ;  Result = "LO/W"
END_LOAD
```

REPLACE Function: Replacing characters

Syntax:	**REPLACE***(string, FindString, ReplaceString [, start [, count]])*	
Description:	The REPLACE function replaces a character/string in a string with another character/string.	
Parameters:	string	String in which FindString is to be replaced with ReplaceString.
	FindString	String to be replaced
	ReplaceString	Replacement string (is used instead of the FindString)
	start	Starting position for search and replace operations
	count	Number of characters that are to be searched from the starting position after the FindString.
Return Value:		
	string = Blank string	Copy of string
	FindString = Blank string	Copy of string
	ReplaceString = Blank string	Copy of string, in which all occurrences of FindString are deleted
	start > Len(String)	Blank string
	count = 0	Copy of string

See also

Use of strings (Page 63)

4.3.27 PI services

Description

The PI_SERVICE function can be used to start PI Services (Program Invocation Services) from the PLC in the NC area.

General programming

Syntax:	**PI_SERVICE** (*service, n parameters*)	
Description:	Executes PI service	
Parameters:	Service	PI service identifier
	n parameters	List of n parameters of PI Service.
		Individual parameters are separated by commas.

Example

```
PRESS (HS2)
  PI_SERVICE("_N_CREATO",55)
END_PRESS
PRESS(VS4)
  PI_SERVICE("_N_CRCEDN",17,3)
END_PRESS
```

Starting OEM services

The PI_START command executes a PI service based on OEM documentation.

Programming

Syntax:	PI_START("*Transfer string*")	
Description:	Executes PI service	
Parameters:	"Transfer string"	Unlike the OEM documentation, the transfer string should be entered in inverted commas.

Example

```
PI_START("/NC,001,_N_LOGOUT")
```

Note

Channel-dependent PI Services always refer to the current channel.

PI services of the tool functions (TO area) always refer to the TO area that is assigned to the current channel.

Graphic and logic elements

5

5.1 Line and rectangle

Description

Lines and rectangles are configured in the LOAD block:

- Lines are first drawn, then the rectangles and finally the configured control fields or graphics.
- Transparent rectangles are created by setting the fill color to the system background color.

LINE element

Programming:

Syntax:	LINE (x1,y1,x2,y2,f,s)	
Description:	Defining a line	
Parameters:	x1	Start point x-coordinate
	y1	Start point y-coordinate
	x2	End point x-coordinate
	y2	End point y-coordinate
	f	Color of the line
	s	Line style: 1 = solid 2 = dashed 3 = dotted 4 = dashed and dotted

RECT element

Programming:

Syntax:	RECT (x,y,w,h,f1,f2,s)	
Description:	Defining a rectangle	
Parameters:	x	x-coordinate, top left
	y	y-coordinate, top left
	w	Width
	h	Height
	f1	Color of the border
	f2	Fill color
	s	Border style:
		1 = solid
		2 = dashed
		3 = dotted
		4 = dashed and dotted

See also

LOAD (Page 81)

5.2 Defining an array

Definition

An array can be used to organize data of the same data type stored in the memory in such a way that it is possible to access the data via an index.

Description

Arrays can be one- or two-dimensional. A one-dimensional array is treated like a two-dimensional array with just one line or column.

Arrays have start identifier //A and end identifier //END. The number of lines and columns is optional. An array is structured in the following way:

Programming

Syntax:	//A*(Identifier)*	
	(a/b...)	
	(c/d...)	
	...	
	//END	
Description:	Defines array	
Parameters:	Identifier	Name of array
	a, b, c, d	Values of array
		Values of the STRING type must be enclosed in double quotation marks.

Example

```
//A(Thread)                          ;   Size/lead/core diameter
(0.3 / 0.075 / 0.202)
(0.4 / 0.1   / 0.270)
(0.5 / 0.125 / 0.338)
(0.6 / 0.15  / 0.406)
(0.8 / 0.2   / 0.540)
(1.0 / 0.25  / 0.676)
(1.2 / 0.25  / 0.676)
(1.4 / 0.3   / 1.010)
(1.7 / 0.35  / 1.246)
//END
```

5.2.1 Accessing the value of an array element

Description

The value of an array access operation can be transferred with property Value (identifier.val).

The line index (line number of the array) and the column index (column number of the array) each begin at 0. If a line index or column index is outside the array, the value 0 or a blank string is output and the ERR variable is set to TRUE. The ERR variable is also set to TRUE if a search concept cannot be found.

Programming

Syntax:	Identifier [Z,[M[,C]]].val or	
	Identifier [Z,[M[,C]]]	
Description:	Access to one-dimensional array with only one column	
Syntax:	Identifier [S,[M[,C]]].val] or	
	Identifier [S,[M[,C]]] or	
Description:	Access to one-dimensional array with only one line	
Syntax:	Identifier [Z,S,[M[,C]]].val or	
	Identifier [Z,S,[M[,C]]]	
Description:	Access to two-dimensional array	
Parameters:	Identifier:	Name of array
		Z:Line value (line index or search concept)
		S:Column value (column index or search concept)
	M:	Access mode
		0 Direct
		1 Searches the line, column directly
		2 Searches the column, line directly
		3 Searches
		4 Searches line index
		5 Searches column index
	C:	Compare mode
		0 Search concept must be located in the range of values of the line or column.
		1 Search concept must be located exactly.

Example

```
VAR1 = MET_G[REG[3],1,0].VAL        ;Assign Var1 a value from array
                                    MET_G
```

Access mode

- **"Direct" access mode**

  With "Direct" access mode (M = 0), the array is accessed with the line index in Z and the column index in S. Compare mode C is not evaluated.

- **"Search" access mode**

  In the case of access mode M = 1, 2 or 3, the search always commences in line 0 or column 0.

Mode M	Line value Z	Column value S	Output value
0	Line index	Column index	Value from line Z and column S
1	Search concept: Search in column 0	Column index of column from which value is read	Value from line found and column S
2	Line index of line from which return value is read	Search concept: Search in line 0	Value from line Z and column found
3	Search concept: Search in column 0	Search concept: Search in line 0	Value from line and column found
4	Search concept: Search in column S	Column index of search column	Line index
5	Line index of search line.	Search concept: Search in line Z	Column index

Compare mode

When compare mode C = 0 is used, the content of the search line or search column must be sorted in ascending order. If the search concept is smaller than the first element or larger than the last, the value 0 or a blank string is output and the error variable ERR is set to TRUE.

When compare mode C = 1 is used, the search concept must be found in the search line or search column. If the search concept cannot be found, the value 0 or an empty string is output and the error variable ERR is set to TRUE.

5.2.2 Example Access to an array element

Prerequisite

Two arrays are defined below. These are the basis for the following examples:

```
//A(Thread)
                    (0.3 / 0.075 / 0.202)
                    (0.4 / 0.1   / 0.270)
                    (0.5 / 0.125 / 0.338)
                    (0.6 / 0.15  / 0.406)
                    (0.8 / 0.2   / 0.540)
                    (1.0 / 0.25  / 0.676)
                    (1.2 / 0.25  / 0.676)
                    (1.4 / 0.3   / 1.010)
                    (1.7 / 0.35  / 1.246)
//END


//A(Array2)
                    ("DES" /        "PTCH" /      "CDM" )
                    (0.3 /          0.075 /       0.202 )
                    (0.4 /          0.1 /         0.270 )
                    (0.5 /          0.125 /       0.338 )
                    (0.6 /          0.15 /        0.406 )
                    (0.8 /          0.2 /         0.540 )
                    (1.0 /          0.25 /        0.676 )
                    (1.2 /          0.25 /        0.676 )
                    (1.4 /          0.3 /         1.010 )
                    (1.7 /          0.35 /        1.246 )
//END
```

Examples

- **Access mode example 1:**

  The search concept is in Z. This key is always sought in column 0. The value from column S is output with the line index of the concept found.

  ```
  VAR1 = Thread[0.5,1,1]   ;VAR1 has the value 0.125
  ```

  Explanation:

  Search for value 0.5 in column 0 of "Thread" array and output the value found in column 1 of the same line.

- **Access mode example 2:**

  The search concept is in S. This concept is always searched for in line 0. The value from line Z is output with the column index of the concept found:

  ```
  VAR1 = ARRAY2[3,"PTCH",2]   ;VAR1 has the value 0.125
  ```

  Explanation:

  Search for column containing "PTCH" in line 0 of array "Array2". Output the value from the column found and the line with index 3.

- **Access mode example 3:**

  A search concept is in each of Z and S. The line index is searched for in column 0 with the concept in Z and the column index in line 0 with the concept in S. The value from the array is output with the line index and column index found:

  ```
  VAR1 = ARRAY2[0.6,"PTCH",3]   ;VAR1 has the value 0.15
  ```

  Explanation:

  Search for the line with the content 0.6 in column 0 of array "Array2", search for the column with the content "STG" in line 0 of Array2. Transfer the value from the line and column found to VAR1.

- **Access mode example 4:**

  The search concept is in Z. S contains the column index of the column in which concept is being searched for. The line index of the concept found is output:

  ```
  VAR1 = Thread[0.125,1,4]   ;VAR1 has the value 2
  ```

  Explanation:

  Search for value 0.125 in column 1 of array "Thread" and transfer the line index of the value found to VAR1.

- **Access mode example 5:**

  Z contains the line index of line in which concept is being searched for. The search concept is in S. The column index of the concept found is output:

  ```
  VAR1 = Thread[4,0.2,5,1]  ;VAR1 has the value 1
  ```

  Explanation:

  Search in line 4 of the "Thread" array for the value 0.2 and transfer the column index of the value found to VAR1. Comparison mode 1 was selected because the values of line 4 are not sorted in ascending order.

5.2.3 Scanning the status of an array element

Description

The Status property can be used to run a scan to find out whether an array access operation is supplying a valid value.

Programming

Syntax:	*Identifier [Z, S, [M[,C]]]*.vld
Description:	Status is a read-only property.
Parameters:	Identifier Name of array
Return Value:	FALSE =invalid value
	TRUE =valid value

Example

```
DEF MPIT = (R///"MPIT",,"MPIT",""/wr3)
DEF PIT  = (R///"PIT",,"PIT",""/wr3)
PRESS(VS1)
  MPIT = 0.6
  IF MET_G[MPIT,0,4,1].VLD == TRUE
    PIT    = MET_G[MPIT,1,0].VAL
    REG[4] = PIT
    REG[1] = "OK"
  ELSE
    REG[1] = "ERROR"
  ENDIF
END_PRESS
```

5.3 Table grid (grid)

Definition

In contrast to the array, the values of a table grid (grid) are continually updated. This involves a tabular representation of the values of system variables that can be addressed using one block in one channel.

Assignment

A variables definition is assigned to the table-elements definition via a table identifier:

- The variables definition determines the values to be displayed and the definition of table elements determines the appearance and arrangement on the screen window. The table grid takes the properties of the IO fields from the variables definition line.
- The visible area of the grid is determined by the width and height of the I/O field. Any lines or columns than cannot be seen can be displayed by scrolling horizontally and vertically.

Table identifiers

Identifiers of a table containing NCK/PLC values of the same type, which can be addressed via a channel block. The table identifier is differentiated from limits or toggle fields by the addition of a % sign in front of it. The file containing the table description can be specified by adding a comma after the identifier and then inserting the name of the file.

System or user variable

This parameter remains empty for table grids, because the column definition lines contain detailed information about the variables to be displayed. The table description can be provided in a dynamic format.

Description

The variables definition will contain a reference to a table description:

DEF *Identifier* =	**Identifier = Name of variable**
	Variable type
	/[Limits or toggle field or table identifier]
	/[Default]
	/[Texts (Long text, Short text|Image, Graphic text, Units text)]
	/[Attributes]
	/[Help display]
	/[System or user variable]
	/[Position of short text]
	/[Position input/output field(Left, Top, Width, Height)]
	/[Colors]

See also

Variable parameters (Page 52)

5.3.1 Defining table grids

Description

The table block comprises:

- Header
- 1 to n column descriptions

Programming

Syntax:	***/IG**(Table identifier/Table type/Number of lines/ [Fixed line attribute],[Fixed column attribute])*	
Description:	Defines table grids	
Parameters:	Table identifiers	The table identifier is used without a leading % sign. It can only be used once in a dialog.
	Table type	0 (default)Table for PLC or user data (NCK- and channel-specific data) 1and others, reserved
	No. of lines	Number of lines including header
		The fixed line or fixed column is not scrolled. The number of columns is the number of columns configured.
	Fixed line attribute	1:Active 0:Not active
	Fixed column attribute	1:Active 0:Not active

5.3.2 Defining columns

Description

For table grids, it is advisable to use variables with an index. For PLC or NC variables, the index number with one or more indices is of significance.

The values displayed in a grid can be modified directly by the end user within the restrictions of the rights granted by the attributes and within any defined limits.

Programming

Syntax:	*(Type/Limits/Empty/Long text,column header/Attributes/Help display/ System or user variable/Column width/Offset1, Offset2, Offset3)*	
Description:	Defines columns	
Parameters:	Similar to variables	
	Type	Data type
	Limits	Limit value MIN, limit value MAX
	Long text, column header	
	Attributes	
	Help display	
	System or user variable	As variable, PLC or NC variables should be entered in double quotation marks.
	Column width	Entry in pixels.
	Offset	The increment sizes to increment each index in order to fill the column are specified in the assigned offset parameter: • Offset1: Step width for the 1st index • Offset2: Step width for the 2nd index • Offset3: Step width for the 3rd index

Variable of type STRING

If the variable is a STRING type, then the length must be specified in the type, e.g.:

```
DEF CHAN STRING [16] TEXT[41]
```

The column definition for the CHAN variable, therefore, starts, e.g. (S16/...).

Column header from text file

The column header can be entered as text or text numbers ($8xxxx) and is not scrolled.

Modifying column properties

The column properties, which can be modified dynamically (written) are:

- Limits (min,max),
- Column header (st),
- Attributes (wr, ac and li),
- Help display (hlp) and
- OPI-Variable (var).

Column properties are modified via the variable identifier in the definition line and the column index (starting at 1).

Example: `VAR1[1].st="Column 1"`

Column properties cannot be read in the LOAD block.

The wr, ac and li attributes can be specified for column definitions.

5.3.3 Focus control in the table grid

Description

The Row and Col properties can be used to set and calculate the focus within a table:

- Identifier.**Row**
- Identifier.**Col**

Programming

Each cell in a table has the Val and Vld properties.

In order to read and write cell properties, a line and column index must be specified in addition to the variable identifiers from the definition list.

Syntax:	Identifier[Line index, column index].val or
	Identifier[Line index, column index]
Description:	Val properties
Syntax:	Identifier[Line index, column index].vld
Description:	Vld properties

Example

```
Var1[2,3].val=1.203
```

If the line and column indices are not specified, the indices of the focused cell apply. This corresponds to:

```
Var1.Row =2

Var1.Col=3

Var1.val=1.203
```

5.4 Custom widgets

5.4.1 Defining custom widgets

Description

User-specific display elements are configured in the dialog using a custom widget.

Software option

In order to use custom widgets in dialog boxes, you require the following software options:

"SINUMERIK HMI sl Runtime OA programming"

"SINUMERIK HMI sl Runtime OA Easy Screen"

Programming

Definition:	**DEF** *(name)*	
Syntax:	**(W///"","***(library name)***.***(class name)***"/////***a***,***b***,***c***,***d***);**	
Description:	W	Defining custom widgets
Parameters:	Name	Custom widget name, freely selectable
	Library name	Can be freely selected, name of the dll (Windows) or (Linux) library file
	Class name	Freely selectable, name of the class function from the previously named library
	a, b, c, d	Position and size of the configuration

Example

A custom widget is defined in the dialog configuration in the following way:

```
DEF Cus = (W///"","slestestcustomwidget.SlEsTestCustomWidget"/////20,20,250,100);
```

5.4.2 Structure of the custom widget library

Description

Essentially, the custom widget library contains a defined class. The name of this class must be specified in the dialog configuration in addition to the library names. Starting from library names, Easy Screen accesses a dll file file with the same name, e.g. :

```
slestestcustomwidget.dll
```

Programming

The class definition of the dll file should look like this:

```
#define SLESTESTCUSTOMWIDGET_EXPORT Q_DECL_EXPORT


class SLESTESTCUSTOMWIDGET_EXPORT SlEsTestCustomWidget : public QWidget
{
 Q_OBJECT
....
....
}
```

5.4.3 Structure of the custom widget interface

Description

The library is supplemented by an interface in order to display the custom widget in the dialog. This contains macro definitions with which Easy Screen initiates the custom widget. The interface is available in the form of a cpp file. The file name can be freely selected, e.g.: `sleswidgetfactory.cpp`

Programming

The interface is defined as follows:

```
#include "slestestcustomwidget.h"   ; The header file for the relevant
                                      custom widgets is inserted at the
                                      beginning of the file
....
//Makros                            ; Macro definitions are not changed
....
WIDGET_CLASS_EXPORT(SlEsTestCustom  ; The relevant custom widget is
Widget)                               declared at the end of the file
```

Example

Content of the file sleswidgetfactory.cpp for a custom widget with the class name SlEsTestCustomWidget":

```
#include <Qt/qglobal.h>
#include "slestestcustomwidget.h"

////////////////////////////////////////////////////////////////////////
// MAKROS FOR PLUGIN DLL-EXPORT - DO NOT CHANGE
////////////////////////////////////////////////////////////////////////

#ifndef Q_EXTERN_C
#ifdef __cplusplus
#define Q_EXTERN_C extern "C"
#else
#define Q_EXTERN_C extern
#endif
#endif
```

```
#define SL_ES_FCT_NAME(PLUGIN) sl_es_create_ ##PLUGIN
#define SL_ES_CUSTOM_WIDGET_PLUGIN_INSTANTIATE( IMPLEMENTATION , PARAM) \
 { \
 IMPLEMENTATION *i = new PARAM; \
 return i; \
 }

#ifdef Q_WS_WIN
# ifdef Q_CC_BOR
# define EXPORT_SL_ES_CUSTOM_WIDGET_PLUGIN(PLUGIN,PARAM) \
 Q_EXTERN_C __declspec(dllexport) void* \
 __stdcall SL_ES_FCT_NAME(PLUGIN) (QWidget* pParent) \
 SL_ES_CUSTOM_WIDGET_PLUGIN_INSTANTIATE( PLUGIN,PARAM )
# else
# define EXPORT_SL_ES_CUSTOM_WIDGET_PLUGIN(PLUGIN,PARAM) \
 Q_EXTERN_C __declspec(dllexport) void* SL_ES_FCT_NAME(PLUGIN) \
 (QWidget* pParent) \
 SL_ES_CUSTOM_WIDGET_PLUGIN_INSTANTIATE( PLUGIN,PARAM )
# endif
#else
# define EXPORT_SL_ES_CUSTOM_WIDGET_PLUGIN(PLUGIN,PARAM) \
 Q_EXTERN_C void* SL_ES_FCT_NAME(PLUGIN) (QWidget* pParent) \
 SL_ES_CUSTOM_WIDGET_PLUGIN_INSTANTIATE( PLUGIN,PARAM )
#endif

#define WIDGET_CLASS_EXPORT(CLASSNAME) \
 EXPORT_SL_ES_CUSTOM_WIDGET_PLUGIN(CLASSNAME,CLASSNAME(pParent))

////////////////////////////////////////////////////////////////////////
// FOR OEM USER - please declare here your widget classes for export
////////////////////////////////////////////////////////////////////////

WIDGET_CLASS_EXPORT(SlEsTestCustomWidget)
```

5.4.4 Interaction between custom widget and dialog

Description

Custom widgets interact with dialog boxes and can display values or manipulate them. Data is therefore exchanged for the following conditions:

Condition	Direction
When starting or recompiling a dialog	Dialog → custom widget
When executing the GC command for generating cycle calls	Custom widget → Dialog

Programming

The following definitions are necessary for the interaction:

Expansion of the dialog configuration

Definition:	**DEF** *(variable)*	
Syntax:	**(***(type)***//5/"","***(variable)***","""/wr2/)**	
Variable type:	Type	Standard input field (no grid or toggle) with any data type (no W)
Parameters:	Variable	Any designation of a variable for data exchange
Input mode:	wr2	Reading and writing

Example

```
DEF CUSVAR1 = (R//5/"","CUSVAR1",""/wr2/)
```

Expansion of the class definition

In the class definition of the custom widgets, a QProperty must be created whose name is identical to the selected variable of the dialog configuration, e.g.:

```
Q_PROPERTY(double CUSVAR1 READ cusVar1 WRITE setCusVar1);
```

Example

The class definition of the dll file should look like this:

```
#define SLESTESTCUSTOMWIDGET_EXPORT Q_DECL_EXPORT


class SLESTESTCUSTOMWIDGET_EXPORT SlEsTestCustomWidget : public QWidget
{
 Q_OBJECT
 Q_PROPERTY(double CUSVAR1 READ cusVar1 WRITE setCusVar1);
....
....
}
```

"Custom" operating area

6

6.1 How to activate the "Custom" operating area

Activating the "Custom" operating area

The "Custom" operating area is not activated on delivery.

1. First, copy the slamconfig.ini file from the /siemens/sinumerik/hmi/templates directory into the /siemens/sinumerik/hmi/cfg directory.
2. To activate the "Custom" operating area, the following must be entered:

```
[Custom]
Visible=True
```

Result

After activation is complete, the softkey for the "Custom" operating area can be found in the main menu (F10) on the menu continuation bar on the HSK4 (= default).

The "Custom" operating area displays an empty window covering the entire operating area, with a configurable header. All horizontal and vertical softkeys can be configured.

6.2 How to configure the "Custom" softkey

Configuring the softkey for the "Custom" operating area

The labeling and position of the softkey for the "Custom" operating area are configured in the slamconfig.ini file.

The following options are available for configuring the start softkey:

1. To replace a softkey label with a **language-dependent text**, the following must be entered in the [Custom] section:

```
TextId=MY_TEXT_ID

TextFile=mytextfile

TextContext=mycontext
```

   In this example, the softkey shows the language-dependent text which was saved with the text ID "MY_TEXT_ID" in text file mytextfile_xxx.qm under "MyContext" (xxx stands for language code).

2. To replace a softkey label with a **language-neutral text**, the following must be entered in the [Custom] section:

```
TextId=HELLO

TextFile=<empty>

TextContext=<empty>
```

   In this example, the softkey for the "Custom" operating area displays the text "HELLO" for every language.

3. **An icon** can also be displayed on the softkey in addition to the text.

   To do this, the following must be entered in the [Custom] section:

   ```
   Picture=mypicture.png
   ```

   The softkey then displays the icon from the file mypicture.png. Graphics and bitmaps are stored at the following path: /oem/sinumerik/hmi/ico/ico<Resolution>. The directory that corresponds to the display resolution must be used.

4. **The position** of the softkey can also be set. The following entry in the [Custom] section can be used to make this setting:

   ```
   SoftkeyPosition=12
   ```

   The default is position 12. This corresponds to the HSK4 on the menu continuation bar of the operating area's menu. Positions 1 - 8 correspond to HSK1 to HSK8 on the menu bar, positions 9 - 16 to HSK1 to HSK8 on the menu continuation bar.

6.3 How to configure the "Custom" operating area

Configuring the softkey for the "Custom" operating area

You need the easyscreen.ini and custom.ini files to configure the operating area. Templates for both these files are available in the /siemens/sinumerik/hmi/templates directory.

1. First copy the files to the /oem/sinumerik/hmi/cfg directory and make your changes from there.
2. File easyscreen.ini already contains a definition line for the "Custom" operating area:

   ```
   ;StartFile02 = area := Custom, dialog := SlEsCustomDialog, startfile := custom.com
   ```

   The ";" at the start of the line represents the comment character. This means the line is commented out and, as such, not active. To change this, the ";" must be deleted.

   The "startfile" attribute in this line is used to define that the entry will refer to the custom.com project file when the "Custom" operating area is selected.
3. You create the **custom.com project file** in the /oem/sinumerik/hmi/proj directory. This contains the relevant configuration, which is created in the same way as the aeditor.com file of the "Program" operating area. The configured start softkeys are then displayed in the "Custom" operating area.
4. You configure the **language-neutral text** for the title bar of the dialog in the custom.ini file.

   The following entry is available in the template for this purpose:

   ```
   [Header]Text=Custom
   ```

   You can replace this text with a customized one.
5. The template contains the following entry for configuring a **start screen** for the "Custom" operating area:

   ```
   [Picture]Picture=logo.png
   ```

   Logo.png is the name of the start screen which appears on the "Custom" operating area's start dialog. Here you can display a company logo, for example, or another image. The file should be saved in the directory for the corresponding resolution under: /oem/sinumerik/hmi/ico/ …

6.4 Programming example for the "Custom" area

File overview

The following files are required:

- custom.ini
- easyscreen.ini

Programming

Content of the custom.com file:

```
//S(Start)
HS7=("Start example", se1, ac7)
PRESS(HS7)
LM("Maske4")
END_PRESS
//END
//M(Maske4/"Example: MCP"/"mcp.png")
DEF byte=(I/0/0/"Input byte=0 (default)","Byte
number:",""/wr1,li1///380,40,100/480,40,50)
DEF Feed=(IBB//0/"","Feed override",""/wr1//"EB3"/20,180,100/130,180,100),
Axistop=(B//0/"","Feed stop",""/wr1//"E2.2"/280,180,100/380,180,50/100)
DEF Spin=(IBB//0/"","Spindle override",""/wr1//"EB0"/20,210,100/130,210,100),
spinstop=(B//0/"","Spindle stop",""/wr1//"E2.4"/280,210,100/380,210,50/100)
DEF custom1=(IBB//0/"," User keys 1",""/wr1//"EB7.7"/20,240,100/130,240,100)
DEF custom2=(IBB//0/"","User keys 2",""/wr1//"EB7.5"/20,270,100/130,270,100)
DEF By1
DEF By2
DEF By3
DEF By6
DEF By7

HS1=("Input byte", SE1, AC4)
HS2=("")
HS3=("")
HS4=("")
HS5=("")
HS6=("")
HS7=("")
HS8=("")
VS1=("")
VS2=("")
```

```
VS3=("")
VS4=("")
VS5=("")
VS6=("")
VS7=("Cancel", SE1, AC7)
VS8=("OK", SE1, AC7)
PRESS(VS7)
  EXIT
END_PRESS
PRESS(VS8)
  EXIT
END_PRESS

LOAD
  By1=1
  By2=2
  By3=3
  By6=6
  By7=7
END_LOAD

PRESS(HS1)
  Byte.wr=2
END_PRESS

CHANGE(Byte)
  By1=byte+1
  By2=byte+2
  By3=byte+3
  By6=byte+6
  By7=byte+7
  Feed.VAR="EB"<<By3
  Spin.VAR="EB"<<Byte
  Custom1.VAR="EB"<<By6
  Custom2.VAR="EB"<<By7
  Axisstop.VAR="E"<<By2<<".2"
  Spinstop.VAR="E"<<By2<<".4"
  Byte.wr=1
END_CHANGE

CHANGE(Axis stop)
  IF Axistop==0
    Axistop.BC=9
  ELSE
```

```
    Axistop.BC=11
  ENDIF
END_CHANGE

CHANGE(Spin stop)
  IF Spinstop==0
    Spinstop.BC=9
  ELSE
    Spinstop.BC=11
  ENDIF
END_CHANGE
//END
```

Result

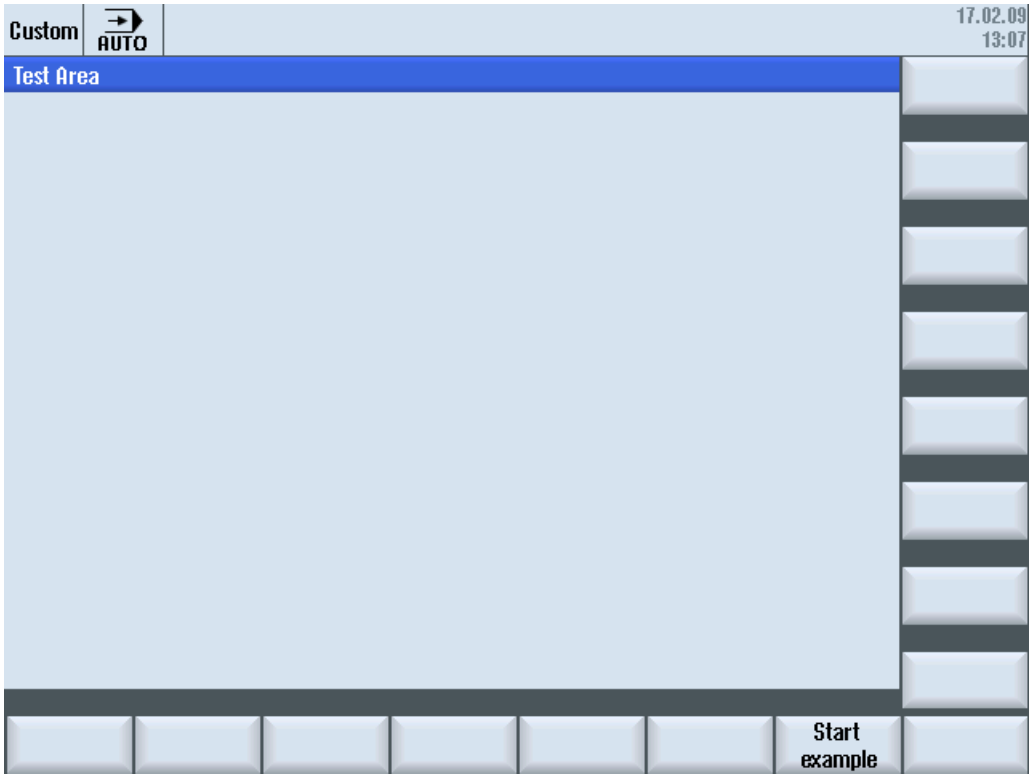


Figure 6-1 Example with "Start example" softkey

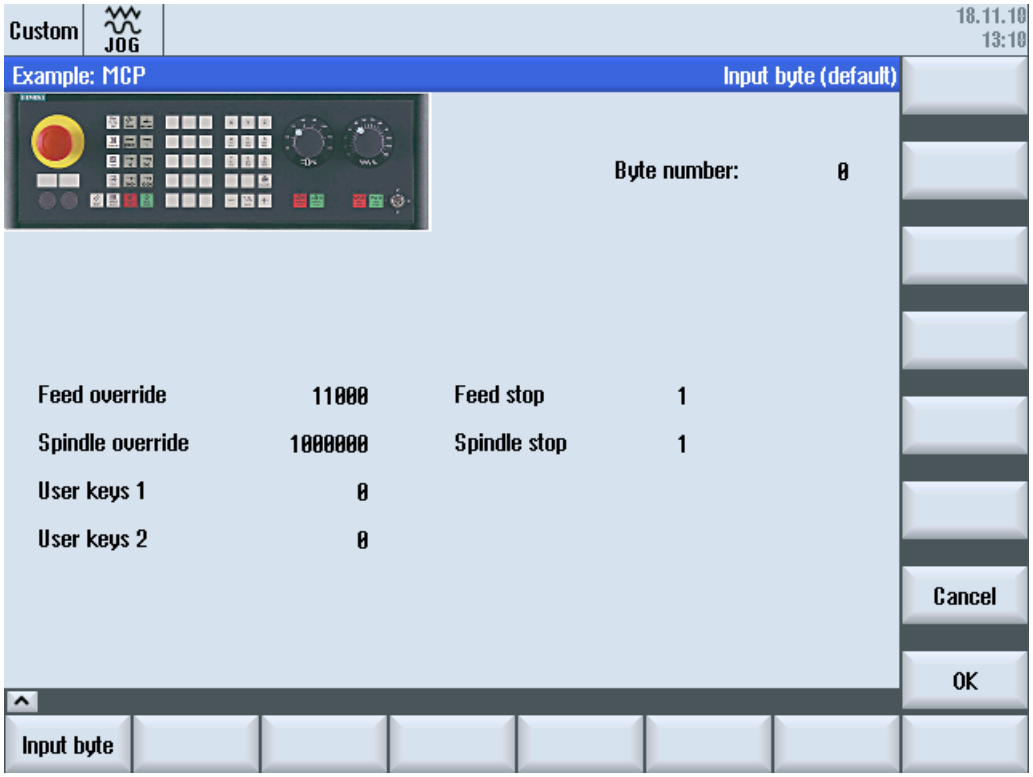


Figure 6-2 Example with bitmap and text fields

PLC softkeys

7

7.1 Introduction

Configuration

Description of the procedure:

- The systemconfiguration.ini contains a section [keyconfiguration]. The entry specifies an action for a special PLC softkey.
- A number is given as an action. An Easy Screen call is involved if the number is greater than or equal to 100.
- A section for defining the action to be performed must be created in the easyscreen.ini file. The name of the section is based on the name of the operating area and the dialog name (see entry under [keyconfiguration] → Area:=..., Dialog:=...) → [<Area>_<Dialog>] → e.g. [AreaParameter_SlPaDialog].
- The action numbers (which were given in the systemconfiguration.ini → see Action:=...) are defined in this section. There are two commands involved:

  1. LS("Softkey menu1","param.com") ... Loading a softkey menu
  2. LM("Screen form1","param.com") ... Loading a screen form

Selecting softkey menus via PLC softkeys

Easy Screen makes it possible to select Easy Screen softkey menus and Easy Screen dialogs via PLC softkeys. This can only be done if the "action" attribute to be specified when configuring the relevant PLC softkeys has a value greater than or equal to 100.

PLC softkeys are configured in the file `systemconfiguration.ini` in the section [keyconfiguration]:

```
[keyconfiguration]

KEY75.1 = Area:=area, Dialog:=dialog, Screen:=screen, Action:= 100,

Cmdline:=cmdline
```

The LM and LS commands to be executed upon activation of the relevant PLC softkeys are configured in the easyscreen.ini file. The names of the sections that are used for the purpose of configuration are structured as follows:

`[areaname_dialogname]`	The first part of the name "areaname" refers to the operating area and the second part "dialogname" designates the dialog to which the commands configured in this section apply.

`[AreaParameter_SlPaDialog]`
`100.screen1 = LS("Softkey1","param.com")`
`101.screen3 = LM("Screen form1","param.com")`
	The names given in the systemconfiguration.ini file for the operating area and dialog should be used. The dialog does not have to be specified.
	This is particularly true for operating areas which are only implemented by means of a single dialog. Please refer to the example on the left.
	If "screen1" is displayed in the AreaParameter operating area implemented by the SlPaDialog dialog, the "LS("Softkey1","param.com")" command will be executed when the "action" with the value 100 occurs.

`action.screen=Command`	Both the "action" and "screen" attributes clearly indicate when the specified command will be executed.
	The "screen" information is optional.
	The following commands are permissible:
	`LM (LoadMask)`
	`LS (LoadSoftkeys)`

Reference lists

A

A.1 Lists of start softkeys

A.1.1 List of start softkeys for turning

Program operating area for turning

Edit	Drilling	Turning	Contour turning	Milling	Miscellaneous	Simulation	NC select
HSK1	HSK2	HSK3	HSK4	HSK5	HSK6	HSK7	HSK8
--	--	--	--	Measure turning	Measure milling	OEM	--
--	HSK10	--	--	HSK13	HSK14	HSK15	--

Turning

The following tables list the possible start softkeys for turning technology. Assignments of individual start softkeys can differ depending on the particular system. The specified OEM softkeys are permitted for Easy Screen.

G code start softkeys:

	Drilling	Turning	Contour turning		Milling		Miscellaneous	
	HSK2	HSK3	HSK4		HSK5		HSK6	
VSK1	Centering	Stock removal	Contour	--	Face milling	Contour	Settings	High speed settings
VSK2	Drilling reaming	Groove	Stock removal	--	Pocket	Path	Swivel plane	Parallel axes
VSK3	Deep-hole drilling	Undercut	Stock removal residual material	--	Multi-edge spigot	Predrilling	Swivel tool	--
VSK4	Boring	Thread	Grooving	--	Groove	Pocket	--	--
VSK5	Thread	Parting	Grooving residual material	--	Thread milling	Pocket res. mat.	--	--
VSK6	OEM	--	Plunge-turning	--	Engraving	Spigot	Subprogram	--
VSK7	Positions	OEM	Plunge turning residual material	OEM	OEM	Spigot res. mat.	--	OEM
VSK8	Repeat position.	--	>>	<<	Contour milling	<<	>>	<<

ShopTurn start softkeys:

	Drilling	**Turning**	**Contour turning**		**Milling**		**Miscellaneous**		
	HSK2	**HSK3**	**HSK4**		**HSK5**		**HSK6**		**HSK10**
VSK1	Drilling centered	Stock removal	New contour	--	Face milling	New contour	Settings	High speed settings	Tool
VSK2	Centering	Groove	Stock removal	--	Pocket	Path	Swivel plane	Parallel axes	Straight line
VSK3	Drilling reaming	Undercut	Stock removal residual material	--	Multi-edge spigot	Predrilling	Swivel tool	Repeat progr.	Circle center point
VSK4	Deep-hole drilling	Thread	Grooving	--	Groove	Pocket	Counterspindle	--	Circle radius
VSK5	Thread	Parting	Grooving residual material	--	Thread milling	Pocket res. mat.	Transformations	--	Polar
VSK6	**OEM**	--	Plunge-turning	--	Engraving	Spigot	Subprogram	--	Approach/retract
VSK7	Positions	**OEM**	Plunge turning residual material	**OEM**	**OEM**	Spigot res. mat.	--	**OEM**	--
VSK8	Repeat position.	--	>>	<<	Contour milling	<<	>>	<<	--

See also

Defining start softkeys (Page 15)

A.1.2 List of start softkeys for milling

Program operating area when milling

Edit	Drilling	Milling	Contour milling	Turning	Miscellaneous	Simulation	NC select
HSK1	HSK2	HSK3	HSK4	HSK5	HSK6	HSK7	HSK8
--	--	--	--	Measure turning	Measure milling	**OEM**	--
--	HSK10	--	--	HSK13	HSK14	HSK15	--

Milling

The following tables list the possible start softkeys for milling technology. Assignments of individual start softkeys can differ depending on the particular system. The specified OEM softkeys are permitted for Easy Screen.

G code start softkeys:

	Drilling	Milling	Contour milling		Turning		Miscellaneous	
	HSK2	HSK3	HSK4		HSK5		HSK6	
VSK1	Centering	Face milling	Contour	--	Stock removal	Contour	Settings	--
VSK2	Drilling reaming	Pocket	Path	--	Groove	Stock removal	Swivel plane	Parallel axes
VSK3	Deep-hole drilling	Multi-edge spigot	Predrilling	--	Undercut	Stock removal residual material	Swivel tool	--
VSK4	Boring	Groove	Pocket	--	Thread	Grooving	High speed settings	--
VSK5	Thread	Thread milling	Pocket res. mat.	--	Parting	Grooving residual material	--	--
VSK6	**OEM**	Engraving	Spigot	--	--	Plunge-turning	Subprogram	--
VSK7	Positions	**OEM**	Spigot res. mat.	**OEM**	**OEM**	Plunge turning residual material	--	**OEM**
VSK8	Repeat position.	--	>>	<<	Contour turning	<<	>>	<<

ShopMill start softkeys:

	Drilling	**Milling**	**Contour milling**		**Turning**		**Miscellaneous**		**Straight line circle**
	HSK2	**HSK3**	**HSK4**		**HSK5**		**HSK6**		**HSK10**
VSK1	Centering	Face milling	New contour	--	Stock removal	New contour	Settings	--	Tool
VSK2	Drilling reaming	Pocket	Path	--	Groove	Stock removal	Swivel plane	Parallel axes	Straight line
VSK3	Deep-hole drilling	Multi-edge spigot	Predrilling	--	Undercut	Stock removal residual material	Swivel tool	Repeat progr.	Circle center point
VSK4	Boring	Groove	Pocket	--	Thread	Grooving	High speed settings	--	Circle radius
VSK5	Thread	Thread milling	Pocket res. mat.	--	Parting	Grooving residual material	Transformations	--	Helix
VSK6	**OEM**	Engraving	Spigot	--	--	Plunge-turning	Subprogram	--	Polar
VSK7	Positions	**OEM**	Spigot res. mat.	**OEM**	**OEM**	Plunge turning residual material	--	**OEM**	--
VSK8	Repeat position.	--	>>	<<	Contour turning	<<	>>	<<	--

A.2 List of colors

System colors

A uniform color table is available for configuring dialogs (subset of the respective standard colors). The color of an element (text, input field, background, etc.) can be selected from the following options (between 0 and 128).

Index	Pictogram	Color	Color description
1		black	
2		orange	
3		Dark green	
4		Light gray	
5		Dark gray	
6		Blue	
7		Red	
8		brown	
9		yellow	
10		White	
128		orange	System color active field
129		Light gray	Background color
130		Blue	Header color (active)
131		black	Header font color (active)

A.3 List of language codes used in file names

Supported languages

Standard languages:

Language	Abbreviation in file name
Chinese simplified	chs
German	deu
English	eng
Spanish	esp
French	fra
Italian	ita

Other languages:

Language	Abbreviation in file name
Chinese traditional	cht
Korean	kor
Portuguese (Brazil)	ptb

Language	Abbreviation in file name
Czech	csy
Hungarian	hun
Japanese	jpn
Polish	plk
Russian	rus
Swedish	sve

Language	Abbreviation in file name
Danish	dan
Finnish	fin
Dutch	nld
Romanian	rom
Slovakian	sky
Turkish	trk

A.4 List of accessible system variables

References

List Manual System Variables/PGAsl/

See also

Multiple Read NC PLC (MRNP) (Page 118)

Glossary

Access level

Graduated system of authorization, which makes the accessibility and utilization of functions on the operator interface dependent on the authorization rights of the user.

Array

An array can be used to organize data of a standard data type stored in the memory in such a way that it is possible to access the data via an index.

Attribute

Characteristic that assigns specific → Properties to an object (→ Dialog or → Variable).

Column index

Column number of an array

Configuration file

File, which contains definitions and instructions that determine the appearance of → Dialogs and their → Functions.

Definition lines

Program section in which → Variables and softkeys are defined

Dialog

Display of the → User interface

- **Dialog-dependent softkey menu**

  Softkey menu, which is called from a newly configured dialog.

- **Dialog-independent softkeys**

  Softkeys, which are not called from a dialog, i.e., start softkey and softkey menus, which the user configures before the first, new dialog.

Editor

ASCII Editor with which characters can be entered in a file and edited.

Event

Any action, which initiates execution of a → Method: Input of characters, actuation of softkeys, etc.

Group

Reload unit for → Configuration file

Help variable

Internal arithmetic variable to which no → Properties can be assigned and is not, therefore, visible in the → Dialog.

Hotkeys

6 keys on OP 010, OP 010C and SINUMERIK keyboards with hotkey blocks. Pressing the keys selects an operating area directly. As an option, 2 additional keys can be configured as hotkeys.

Input/output field

Also I/O field: for inputting or outputting variable values.

Interpreter

The interpreter automatically converts the defined code from the → Configuration file into a → Dialog and controls its use.

Line index

Row number of an array

Menu tree

A group of interlinked → Dialogs

Method

Programmed sequence of operations executed when a corresponding → Event occurs.

Parameter

Parameters are variable elements of the programming syntax and are replaced by other words/symbols in the → Configuration file.

PI service

Function which, on an NC, executes a clearly defined operation. PI services can be called from the PLC and the HMI system.

PLC hard key

PLC hard keys are provided via the PLC interface of the HMI software, just like hotkeys. The functions triggered by them in the HMI can be configured.

They take the form of MCP keys or evaluations of PLC signal logic operations in the PLC user program. For this reason, they are referred to as "virtual keys".

Programming support

Provision of → Dialogs to assist programmers in writing → Parts programs with "higher-level" components

Properties

Characteristics of an object (e.g of a → Variable)

Recompile

NC code sections can be generated in a → Part program from input fields in → Dialogs in the → Programming support system. Recompilation is the reverse operation. The input fields used to generate a selected section of NC code are retrieved from the NC code and displayed in the original dialog.

Selecting

A program formulated in the NC language, which specifies motion sequences for axes and various special actions.

Simulation

Simulation of a → Parts program run without movement of the actual machine axes.

Softkey labels

Text/image on the screen, which is assigned to a softkey.

Softkey menu

All horizontal or all vertical softkeys

Start softkey

Softkey with which the first newly created → Dialog is started.

Toggle field

A list of values in the → Input/output field; check with toggle field: The value input in a field must be the same as one of the listed values.

User variable

Variables defined by the user in the → Parts program or data block.

Variable

Designation of a memory location, which can be displayed in a → Dialog by assigning → Properties and in which input data and the results of arithmetic operations can be entered.

Index

G

H

I

L

M

N

O

P

R

S

T

U

V

W

SIEMENS

SINUMERIK

SINUMERIK 840D sl
NCU operating system (IM7)

Commissioning Manual

Valid for:

CNC software for 840D sl/ 840DE sl Version 4.5

02/2012
6FC5397-1DP40-3BA0

Legal information

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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.

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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 relevant information is not taken into account.

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Table of contents

System settings

1

1.1 Delivery condition of the system

Scope of validity

This document is valid for all systems that are supplied with Linux as operating system on the CompactFlash Card, such as all NCUs of the type NCU 7x0.

Directory on the CompactFlash card

A Linux partition as well as a FAT partition are available on the CompactFlash Card. The memory space of the CompactFlash Card is occupied mainly by the Linux-EXT3 partition containing the system software and the user data. A 2MB large FAT partition still exists but only for internal administration purposes.

When the system is in operation, the following directories (this is a selection and not a complete list) are available in the EXT3 partition on the CompactFlash Card:

Directory	Use
/siemens	Reserved for Siemens system software
/addon	Reserved for Siemens add-on software
/oem	Additional software and configurations of the machine manufacturer
/user	• Storage of user data • Configuring the HMI application • Data that are created when commissioning the system using the HMI application.
/system	Linux operating system
/user/system/etc	File basesys.ini (modifications possible)
/user/common/tcu	TCU configuration files
/var/log/messages	System log file (same as event.log under Windows)

Note

Files in the directory under /user always have priority over files with the same name in the directory /oem → /addon → /siemens.

Partitioning of the memory

The memory of the CompactFlash Card is purely logically partitioned, i.e. the user can in principle assign the memory up to the end of the physical limit. An alarm under LINUX is triggered if less than 4 MB free memory is available.

Directory	1 GB card	8 GB card
/oem /addon	100 MB	1 GB
/user	256 MB	2 GB

Preset users

The following users have already been set up:

Users	Access level	Target group
Operator	Key switch position 0	Operators, users
Operator1	Key switch position 1	Operators, users
Operator2	Key switch position 2	Operators, users
Operator3	Key switch position 3	Operators, users
user	Password: CUSTOMER	Operators, users
service	Password: EVENING	Service personnel
manufact	Password: SUNRISE	Machine manufacturer

1.2 Meaning of switch positions

Overview

The NCU has two twist buttons in the lower section of the front panel.

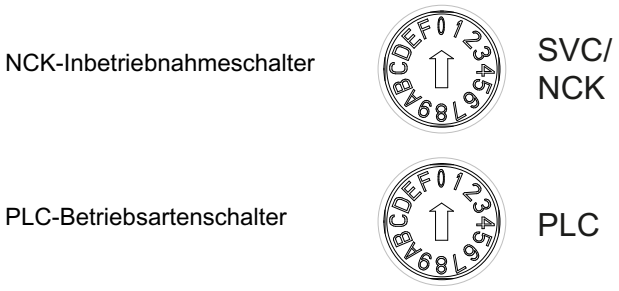

Figure 1-1 Startup and mode selector switch

Rotary switch SVC/NCK

The switch positions have the following significance:

Switch position	Operating mode of the NCK
0	Normal boot-up NCK
1	NCK boot-up with default values (= memory reset)
2	The NCK (and PLC) starts up with the data that was saved at the last shutdown.
7	Debug mode (NCK is not started.)
8	IP address of the NCU is displayed on the seven-segment display.
All others	Not relevant

PLC twist button

The switch positions have the same significance as for a SIMATIC S7-CPU:

Switch position	Operating mode of the PLC
0	RUN
1	RUN (protected mode)
2	STOP
3	Memory reset (MRES)
All others	Not relevant

1.3 System booting

Sequence

To ensure unproblematic booting of the NCU, the CompactFlash Card must be inserted.

When the NCU is booting up, visual information on the current operating system is provided using the following displays:

- The RDY-LED flashes slowly yellow when the CF card is accessed.
- During booting, the 7-segment display outputs different codes that indicate, for example, when the BIOS is started, when the CompactFlash Card is accessed, etc.

When the booting has been completed successfully, the following is displayed:

- The PLC LED lights up green.
- The 7-segment display shows "6." with a flashing dot.
- The RDY-LED lights up green. All other LEDs are not illuminated.

Performing a reset operation

The reset button is located behind the blanking plate of the NCU.

A reset operation resets the entire system and requires a system restart. This is comparable to a "Power On reset" except that the 24 V power supply does not have to be switched off.

Booting for servicing purposes

For service or diagnosis purposes, the NCU can be booted from a service system, the Emergency Boot System.

See also

How do you create a service system for the NCU? (Page 57)

1.4 Displays during system booting

Behavior of the LEDs when booting

Of the LEDs on the front panel of the NCU, only the RDY LED and its status is important when booting up the NCU.

LED: RDY	LED designations: RUN STOP SU/PF SF DP1 DP2 OPT	State/phase	7-segment display
Orange	Orange	BIOS boot	Post codes, see table: Load BIOS
Slowly flashing orange (0.5 Hz)	Set by PLC/option module	Booting up the kernel Phase 2: Initialization of the driver	1
Slowly flashing orange/green (0.5 Hz)	Set by PLC/option module	Booting the basic system Phase 3: Initialization of the basic system	See table: Load operating system
OFF	Set by PLC/option module	NRK/NCK outputs	See table: NRK/NCK outputs
green/red flashing 0.5 Hz)	Set by PLC/option module	Basic system shutdown	OFF
red	Set by PLC/option module	Kernel shutdown	OFF
red (5 Hz)	Set by PLC/option module	SINAMICS fault	---

SINAMICS faults and alarms, also see: SINAMICS S120/S150 List Manual (LH1)

Load BIOS

7-segment display	Meaning
00	Before loading the Master Boot Record (MBR) from the CompactFlash Card
01	Before starting the Master Boot Record (MBR) codes
02	Master Boot Record (MBR) code started
03	Second stage of the boot loader started, before reading the configuration file
04	Before loading the kernel
05	Before starting the kernel

Booting the basic system

7-segment display	Meaning
1 (begin)	Basis initializations
2 (prepfs)	Cleaning up and preparing the file system
3 (hostname, loopback)	The name is set and the loopback interface configured.
4 (syslog)	Starting the system logging Starting the CFS class 1, provide the network interfaces.
5 (network)	Initializing the network interfaces and the firewall
6 (NCU:rtai, TCU:tcuconfig)	Starting the time server (ntpd)
7 (lsh)	Starting the SSH server (if required, generate a host key if still not available).
8 (NCU:ftpd, TCU:mtouch)	Starting the FTP server
9 (NCU:tcuservices, TCU:usbexport)	Starting the TCU services (TFTP, VNC)

NRK/NCK outputs

7-segment display	Meaning
1	Not applicable.
2	Not applicable.
3	Debugger was initialized.
4	NRK operating system was successfully activated.
5	NRK operating system has booted, init task is being processed (→ the application boots).
6 6.	Initialization was successfully performed; the control is in cyclic operation. with flashing point: The control is in cyclic operation and the cycles are active.
F	Internal error: Can only be read via additional diagnostics.
1 or 2	CompactFlash Card and SRAM data do not match. To resolve this problem, a general reset is required by booting with switch position 1 or 2.
Lxx=yyy	Internal error when starting NCK, "xx" is the line number in the mcsystem.ini, "yyy" is a unique error code for the code position.

System error

LED: RDY	LED designations: RUN STOP SU/PF SF DP1 DP2 OPT	Meaning	7-segment display
Rapidly flashing red (2Hz)	Set by PLC/option module	Permanent error: The system is stopped.	see the following table
Rapidly flashing red/orange (2 Hz)	Set by PLC/option module	Temporary error: The system may continue to run with restricted functions.	

7-segment display	Meaning
Permanent error:	
C	"crash": The operating system crashes (this approximately corresponds to a Blue Screen for Windows); details can be found in the system log file.
P	"partition": Error when repartitioning
Temporary error:	
E	"error": A read or write error has occurred on the CompactFlash Card (an additional point is displayed for a write error). It is possible that the CompactFlash Card is defective and should be replaced.
F	"full": The CompactFlash Card is too full, so it is probable that not all of the services will be able to be successfully started. When booting, this error is displayed for 1 minute; the system then continues to boot, however, it can be assumed that problems will occur.

Configuring the system 2

2.1 Ethernet interfaces of the NCU

Supplementary conditions

For the operation of an NCU:

- No more than one NCU may be operated as a DHCP server on the system network.
- An external mouse is recommended when using the System Network Center.

Configuration of the interfaces

The following connections can be established via the Ethernet interfaces:

Interface	Labeling	Internal name	Terminal settings
Ethernet IE1/OP	X120	(Eth 2)	Connection to the system network with preset IP address 192.168.214.1 with subnet screen form 255.255.255.0 and active DHCP server for SINUMERIK
Ethernet IE2/NET	X130	(Eth 1)	Connection to company network as standard DHCP client
Ethernet	X127	(Ibn 0)	Service terminal with fixed IP address 192.168.215.1 and fixed subnet screen form 255.255.255.224 with active DHCP server

Network interface

The network interface is an interface that enables network communication. These are the Ethernet interfaces on the NCU.

VNC (Virtual Network Computing)

Virtual Network Computing is a software that displays the screen contents of a remote computer, with a running VNC server, on a local computer, with a running VNC viewer, and in return sends keyboard and mouse movements of the local computer to the remote computer.

Reference

Operator Components and Networking Manual

2.2 How to determine the IP address of the NCU

Note

SINUMERIK Operate operating software

In order to change network settings, for example the IP address at X130 and X120, diagnostic dialogs are available in SINUMERIK Operate in the operating area. Alternatively, the following options are available.

Determining the IP address of the NCU on the company network (X130)

On X130, the NCU is set to the address reference via DHCP. If the company network has a DHCP server no further settings are required.

There are several possibilities for determining the address that the NCU obtained on the company network, and these possibilities are listed below:

- If the NCU boots in switch position 8, it shows the IP address on X130 on the 7-segment display.
- Once the NCU has booted successfully, open a service shell on the TCU and execute the following command to obtain the desired information:

```
SC SHOW IP
```

Changing the IP address

If the company network has no available DHCP server or if this cannot be used, you are given the option to set a fixed address for the NCU on X130 (in accordance with the addresses already used on the company network).

Example:

The following command displays the IP address at X130:

```
SC SHOW IP -X130
```

NCU in the system network (X120)

On X120, the NCU is pre-selected as required: No settings are necessary.

See also

Generic elements (Page 36)

2.3 Configuration file "basesys.ini"

Storage path

For a Linux basic system the original file can be found on the CompactFlash Card under the path /system/usr/etc. OEM versions are stored under /oem/system/etc, as well as user versions under /user/system/etc.

NOTICE
Only the basesys.ini file parameters described in this chapter can be changed. The "System Network Center" can also be used for this purpose. Use the "sc start snc" command to call this program. To operate it, you will need a mouse.

Use

Settings are made in the basesys.ini file that specify the behavior of the system in the network.

To edit the basesys.ini file:

- Comments are introduced by ';' or '#' at the beginning of the line, and span the width of the line. Empty lines are also handled as comments.
- The sections that start with a "[NAME]" line are ignored by the basic system itself, but are sometimes used by the HMI.
- Variable definitions are written in the form "NAME=VALUE". Blanks are permitted around the '=' character. The value may also be enclosed in double quotation marks, but this is optional.

NOTICE
Suitable editors for Linux In most Linux system files, lines may only be ended with LF, and not with CRLF as in Windows. Please take note of this when selecting an editor. The HMI application editor under "Commissioning" is suitable. In the Linux operating system, the UNIX editor vi is available. Please take note that the Linux operating system is case-sensitive.

See also

Delivery condition of the system (Page 5)

2.3.1 Section [ExternalInterface]

Description

In this section, the parameters and settings for the external Ethernet interface are defined. For an NCU7x0, this is X130 (Eth1). If the external interface is in DHCP mode, i.e. the value of ExternalIP is empty or not defined, then all parameters listed here, with the exception of "DHCPClientID", are accepted by the DHCP server as long as the server provides a value for the parameter.

DisableCompanyNet

If this variable is set to 1, the X130 interface to the company network is not initialized and is thus not available.

Value: Empty, 0 or 1
Default: Empty

ExternalIP

If ExternalIP is not empty, the fixed IP address specified there is used on the company network interface. The ExternalNetMask then also needs to be set, as well as the gateway, name servers, host name, and domain if required.

If ExternalIP is not set or is empty, a DHCP client is started on the interface.

Value: IP address
Default: Empty

ExternalNetMask

ExternalNetMask must be set together with ExternalIP, in order to define the size of the network.

Value: Subnet mask
Default: Empty

Gateway

If the value of gateway is not empty, the host specified there is used as the default gateway, which means that all IP packages that cannot be directly assigned are sent here for routing.

If no gateway is specified, only the networks that are directly connected are accessible.

Value: IP address
Default: Empty

Nameservers

If DNS name servers are specified here, then these must be used to resolve symbolic host names, i.e. at most of the points where an IP address is expected, a computer name can also be used instead.

The name server setting is also sent to your DHCP client (TCU, PG) via the DHCP server of the NCU, so that this can also work with symbolic names.

Value: List of IP addresses (separated by a space)
Default: Empty

Timeservers

Here you can specify a list of NTP servers (UDP/123) that can be used by the NTPD on the NCU for time synchronization.

Value: List of IP addresses (separated by a space)
Default: Empty

Hostname

Here you can define a name for the local host. This manually assigned name takes priority over all other names.

The host name is determined in the following order:

- Host name from the basesys.ini file, if set
- A name received from the DHCP server (if DHCP client mode and a name have been supplied), the result of a reverse DNS lookup, i.e. which name belongs to the IP received (if nameservers are defined)
- A default name ("NONAME_...")

Because the host name is also used as DNS name it must satisfy the corresponding requirements of the RFC:

- ASCII letters (a-z, A-Z), numbers (0-9) and '-'
- max. 63 characters

Value: Name
Default: Empty

Domain

These variables can be used to configure the DNS domain. The effect is that names in this domain can be resolved without qualification (e.g. if the domain is "test.local", you can also specify the name "computer1.test.local" as "computer1").

Value: Name
Default: Empty

DHCPClientID

With these variables, you can influence which ClientID the DHCP client presents to its server. This ID can be used by the server to assign certain parameters to the client, for example a static IP address.

Usually, the MAC address of the Ethernet interface is used for this purpose. This is also the default setting. Alternatively, you can also use the host name ("@NAME"), which must then be defined in the basesys.ini, in order to be recognized before the DHCP request. It is also possible to use an arbitrary string for ClientID.

Value: @MAC, @CFID, @NAME or any string
Default: @MAC

2.3.2 Section [InternalInterface]

Description

In the section [InternalInterface] the data is specified for synchronization of the DHCP server in the system network.

DisableSysNet

If this variable is set to 1, the X120 interface to the plant network is not initialized and is thus not available.

Value: Empty, 0 or 1
Default: Empty

InternalIP

Use this variable to set the fixed IP address in the system network. InternalIP should always be used together with InternalNetMask.

Value: IP address
Default: 192.168.214.1

InternalNetMask

Specifies the subnet mask for InternalIP and should always be used together with it.

Value: Subnet mask
Default: 255.255.255.0

InternalIP_Alias

Use this variable to define an additional alias IP address for the interface of the system network (X120); this is practical in certain application cases.

Value: IP address
Default: Empty

InternalIP_Alias should always be used together with InternalNetMask_Alias.

InternalNetMask_Alias

This variable specifies the subnet mask for InternalIP_Alias and should always be used together with it.

Value: Subnet mask
Default: Empty

SyncModeDHCPD_SysNet

If this variable is not set on "OFF" then the DHCP servers synchronize themselves in the system network (X120) so that only one of them actively assigns addresses. This makes it possible to operate multiple NCUs or PCUs concurrently without having to adjust the network settings.

Value: ON_MASTER, ON_HIGH (= ON), ON_LOW, or OFF
Default: ON_HIGH

The DHCP servers that are not active go into "standby" mode; in this mode they regularly get the current address data and TCU data from the active server so that if the active server fails a standby server can take over the active role without data loss.

- With the **ON_MASTER** setting instead of **ON_HIGH** you can influence the synchronization in such a manner that the server with the "Master" setting is always the active server (for this it must be active on the network). This means that in the normal situation deterministically the same controller is always the DHCP server and you can find the actual address data (/var/etc/udhcp-eth0.leases) and the TCU data /user/common/tcu/etc.) there. ON_MASTER should only be set for a single DHCP server in the system network; there should not be multiple masters.
- The **ON_LOW** setting assigns the DHCP server a lower priority than normal. It then becomes the active server if no server with ON_HIGH or ON_MASTER is found in the network.

Note

Compatibility with earlier versions

The priority level "ON_LOW" is used automatically if the DHCP server was previously switched off with the no longer available variable DisableDHCPDeth0=1. Such an NCU then indeed does have a (standby) DHCP server and keeps a backup of the lease data, however normally it does not become an active server.

InternalDynRangeStart

With the two variables InternalDynRangeStart and InternalDynRangeEnd, you can explicitly specify the range of IP address assigned by the DHCP server. The number band of the presetting should normally suffice.

Value: IP address
Default: First address in the system network + 10 or +2 (if ≤ 16 addresses)

InternalDynRangeEnd

Value: IP address
Default: Last address in the system network - 15 or -1 (if ≤ 16 addresses)

DHCPDNoMasterWait

If a synchronizing DHCP server has once seen a master server in the past, then it waits for synchronization until the time specified here elapses before it becomes the active server.

This additional pause makes it possible for the intended DHCP master to become the active DHCP server without displacement even if it is shortly switched on thereafter, or takes longer to boot than other controllers.

Value: Time in seconds
Default: 120

InternalDNSDomain

This is used to specify the Top Level Domain (TLD) name that is used in the system network. The DNS server of the NCU assigns names to the devices in the system network in this zone. Name requests for all other zones are forwarded to an external name server in the company network.

As presetting the "local" recommended by the RFC1035 is used for local networks, to avoid conflicts with globally defined domain names. Recommendation: The preset should be maintained.

Value: Domain name (letters, numbers, '-', '_', max. 63 characters)
Default: local

2.3.3 Section [IBNInterface]

Description

The settings in this section affect interface X127.

EnableDHCP_IBNNet

If this variable is set to 1 then this prevents the start of the DHCP server at the commissioning interface X127.

Value: Empty, 0 or 1
Default: Empty

DisableIBNNet

If this variable is set to 0, then the commissioning interface X127 is not initialized and is thus not available.

Value: Empty, 0 or 1
Default: Empty

EnableSysNetToIBNForwarding

If this variable is set to 1, it is possible to transmit packages from the system network (X120) to X127. A firewall usually prevents this.

It is important to remember that there is no NAT involved, and the sender is responsible for ensuring (with a suitable routing entry, for example) that packages sent to the PG or service PC on X127 with the address 192.168.215.x only reach the NCU to which the device is connected.

Value: Empty, 0 or 1
Default: Empty

DisableIBNForwarding

If this variable is set to 1, the NAT transfer of packages from the service connection X127 to the system network (X120) is deactivated.

Value: Empty, 0 or 1
Default: Empty

2.3.4 Section [SNMP]

Description

Character strings delivered via SNMP (Simple Network Management Protocol) are entered here. This is a way of giving out information.

SNMPLocation

This string is used for the standard OID SNMPv2-MIB::sysLocation. It is possible to specify a location here, which can be subsequently called with an SNMP client.

Value: Any character string
Default: Empty

SNMPContact

This string is used for the standard OID SNMPv2-MIB::sysContact. It is possible to specify a contact address here, which can be subsequently called with an SNMP client.

Value: Any character string
Default: Empty

SNMPAutLocation

This string is used for the Siemens-specific OID automationSystemIdent.automationLocationTag. It is possible to specify an additional location here, which can be subsequently called with an SNMP client. This is similar to SNMPLocation in terms of the MIB description, although it is intended for entries relating to automation.

Value: Any character string
Default: Empty

SNMPFunction

This string is used for the Siemens-specific OID automationSystemIdent.automationFunctionTag. It is possible to specify a function designation here, which can be subsequently called with an SNMP client.

Value: Any character string
Default: Empty

SNMPStation

This string is used for the SINUMERIK -specific OID mcSinumerikMIB.mcSinumerikMiscStation. The value is the name of a station to which the device belongs. Devices with the same station name are therefore identified as being contiguous.

Value: Any character string
Default: Empty

See also

Example: Configuration file 'basesys.ini' (Page 28)

2.3.5 Section [DCP]

Description

The parameters in this section define the properties of the DCP protocol (Discovery and Basic Configuration Protocol) e.g. that are used in the menu item "Accessible participants" of STEP 7 is used.

InternalDcpEnabled

This can be used to switch-on and switch-off the DCP in the system network (X120); for the NCU, the value is also used for X127.

Value: 0 or 1
Default: 1

ExternalDcpEnabled

This can be used to switch-on and switch-off the DCP in the company network (X130).

Value: 0 or 1
Default: 0

2.3.6 Section [LLDP]

Description

The parameters in this section define the properties of the LLDP protocol (Link Layer Discovery Protocol), which is used by several applications for network diagnostics.

InternalLldpEnabled

This can be used to switch-on and switch-off LLDP in the system network (X120); for the NCU, the value is also used for X127.

Value: 0 or 1
Default: 1

ExternalLldpEnabled

This can be used to switch-on and switch-off LLDP in the company network (X130).

Value: 0 or 1
Default: 0

InternalLldpTLVsTxEnabled

Using this parameter, additional information in the LLDP packages are enabled at X120/X127, which are normally not included.

Value: Numerical value from 0 ... 15
Default: 0

The value is a bit field, i.e. the total value is obtained as a sum (total) of the specified numbers, if the corresponding information is to be sent:

1: port description
2: system name
4: system description
8: capabilities

ExternalLldpTLVsTxEnabled

Using this parameter, additional information in the LLDP packages is enabled at X130, which are normally not included.

Value: Numerical value from 0 ... 15
Default: 0

The value corresponds to parameter InternalLldpTLVsTxEnabled.

2.3.7 Section [LinuxBase]

Description

Additional setting possibilities of the Linux system are combined in this section.

Synchronizing the time

There are two different cases:

- If there is an external NTP server to act as a time server (entered in the basesys.ini file or via DHCP), then the PLC clock is synchronized via the Linux clock.
- If there is no external time server, the PLC clock will be the master for the Linux clock.

NOTICE
Power on the PLC in switch setting 3: "MRES" With "memory reset" the time of the PLC clock remains intact and is not reset. If the PLC is switched on in switch position 3 "MRES" then the time will be reset. In this case the valid time is taken over from the Linux system and does not need to be reset.

Timezone

The time zone set here is used by the system to convert UTC time into local time. The time zone is also sent to all applications via the environment variable TZ, and is taken into account by the libc function localtime().

The time zone influences all time entries in the basic system, particularly for the command "`date`", for "`ls -l`", and in the system log file (on the CompactFlash Card under /var/log/messages).

Value: Time zone description
Default: UTC

Examples:

Europe:	WET0WEST,M3.5.0,M10.5.0
	CET-1CEST,M3.5.0,M10.5.0
	EET-2EEST,M3.5.0,M10.5.0
USA:	EST5EDT,M4.1.0,M10.5.0
	CST6CDT,M4.1.0,M10.5.0
	MST7MDT,M4.1.0,M10.5.0
	PST8PDT,M4.1.0,M10.5.0
China:	CST-8
Japan:	JST-9

LogFileLimit

The size of the system logfile `/var/log/messages` can be restricted with the help of this variable. By entering "Zero", the logfile has no size limitations.

The specified limit is no hard limit for reasons of efficiency but rather a sort of limit value. If the logfile reaches a limit value times factor 1.5, then it is reduced to around 75% of the limit value. A check is carried out every two minutes maximum to see if the file has become too large.

Value: Size in KB
Default: 100 KB

FirewallOpenPorts

Here you can specify a list of the ports which is to be enabled in the firewall of the external network interface. Always enabled are TCP/22 (ssh) and TCP/102 (S7 communications). Logfile is "TCP" or "UDP", the port is the (numerical) port number of the service to be enabled.

Value: List of logfile/port pairs
Default: Empty

Several entries are separated by a space.

For example, you can additionally enable the VNC server:

```
FirewallOpenPorts=TCP/5900 TCP/5904 TCP/5905
```

NOTICE
Security Note that opening the ports in the firewall can represent a security risk. Only enable the ports that you actually require. Note that every accessible service can have security gaps.

DisableSubsystems

Using this variable, you can suppress mounting and starting of certain subsystems (CFS systems). Several subsystem names, too, can be specified - separated by blanks.

Value: List of CFS names (separated by a space)
Default: Empty

The names can either be simple CFS basic names (e.g. "nck") - ignoring all CFS systems with this name - or you specify an absolute path (e.g. `/siemens/sinumerik/nck`) referring specifically to this CFS system.

It is also possible to set "DisableSubsystems=all" whereby not a single CFS system can be mounted or started any more.

DisablePLCTimeSync

If this variable is set to 1, synchronization of the system time with the PLC time (in both directions) will not be executed.

Value: 0 or 1
Default: 0

EnableCoreDumps

If this variable is set as equal to 1, a logfile for processes is created and stored under `/var/tmp`. The protocol file contains a memory print of the process that has crashed or that has terminated.

Value: Empty, 0 or 1
Default: 0

2.3.8 Example: Configuration file 'basesys.ini'

Configuration file basesys.ini

The following defaults are applied to the template_basesys.ini file which is supplied in the directory /siemens/system/etc.:

```
; ------------------------------------------------------------------
; Default Linux basesystem configuration
; ------------------------------------------------------------------
;
; section ID is for Windows compatibility and is ignored ;)
[ExternalInterface]


; If DisableCompanyNet is set to 1, the whole interface will
; be disabled.
;DisableCompanyNet=1


; If ExternalIP is set, you can force the external Ethernet
; interface to use a fixed IP address etc. instead of using DHCP
; if a Hostname is set, it even overrides one received by DHCP
;ExternalIP=210.210.210.210;ExternalNetMask=255.255.255.0;Gateway=210.210.210.1;Names
ervers=210.210.210.1
210.210.210.2;Timeservers=210.210.210.3;Hostname=somename;Domain=example.com
; if ExternalIP is empty (default), DHCP is used with the following
; ClientID the default is "@MAC" to use the MAC address,
; alternatives are "@NAME" to use the hostname (Hostname above)
; "@CFID" to use the ID of the CF card if one is available
; (like on X120), or any other arbitrary string
```

```
;DHCPClientID=@MAC
[InternalInterface]

; If DisableSysNet is set to 1, the whole interface will
; be disabled
;DisableSysNet=1

; With InternalIP and InternalNetMask (both must be set together), you
; can change the address on the internal/TCU/automation/system net.
;InternalIP=192.168.214.1;InternalNetMask=255.255.255.0
; These two can define an alias IP for X120.
;InternalIP_Alias=192.168.216.1;InternalNetMask_Alias=255.255.255.0
; This defines a "name of station" for ProfiNet (ERTEC interface)
; for use with DCP, default is the normal hostname.
; Please be careful if a PN-Name can also be set by other means,
; for example by NCU-Link. Usually it is not needed to define
; a name here.
;PN_StationName="PN_IO"

; Setting EnableDHCPD_SysNet to 0 suppresses that a DHCP server is started on
; that interface
;EnableDHCPD_SysNet=0

; Set synchronization of all DHCP servers in the
; system/TCU network (X120). Possible values are:
; OFF,
; or ON_LOW (low priority),
; or ON or ON_HIGH (normal priority),
; or ON_MASTER (highest priority),
; or ON_CLIENT_SYNC (starts DHCP client only, synchronization active),
; or ON_CLIENT_NO_SYNC (starts DHCP client only, synchronization
; inactive),
; ON_MASTER is used to make this machine deterministically the
; DHCP master server, but should be used only for one server
; in the network.
```

```
;SyncModeDHCPD_SysNet=ON

; This is the range of dynamic IPs given out by the DHCP server
; Defaults should be sensible
InternalDynRangeStart=192.168.214.10InternalDynRangeEnd=192.168.214.239
; If once a DHCP master was seen, the DHCP server waits this many seconds
; for the master to show up before trying to become the active server
;DHCPDNoMasterWait=120

; DNS domain name used for names in system/TCU network
; (default is "local" to conform with RFC)
InternalDNSDomain=local

; FixedDomain and FixedNameservers can be used to define a DNS domain and
; nameservers, if the DHCP/DNS server on system network is disabled
;FixedDomain=local
;FixedNameservers=192.168.214.1

; If DisableNATRouting is set to 1, the NCU won't forward
; from TCU or IBN net
; (X120 anad X127, resp.) to external net (X130).
; If set to "X120" or "X127", forwarding will only be
; disabled from that interface.
;DisableNATRouting=1

[IBNInterface]

; If DisableIBNNet is set to 1, the whole interface will be disabled
;DisableIBNNet=1

; Setting EnableDHCPD_IBNNet to 0 suppresses that a DHCP server is started on
; that interface
;EnableDHCPD_IBNNet=0

; If DisableIBNForwarding is set to 1, the NCU won't do NAT routing
```

```
; from IBN network (X127) to system network (X120).
;DisableIBNForwarding=1

; If EnableSysNetToIBNForwarding is set to 1, the NCU forwards packets from
; X120 to X127. (Please note that the sending host must be able to route
; the packets to the NCU by its own means, the NCU just accepts and forwards
; packets to 192.168.215.x with this setting.)
;EnableSysNetToIBNForwarding=1

[SNMP]
; The following variables define strings which are delivered on
; certain SNMP requests.
; SNMPLocation and SNMPContact are reported for the standard OIDs
; SNMPv2-MIB::sysLocation and SNMPv2-MIB::sysContact, resp.
; SNMPAutLocation and SNMPFunction are used in the Siemens A&D specific
; AUTOMATION-SYSTEM-MIB as automationSystemIdent.automationLocationTag
; and automationSystemIdent.automationFunctionTag, resp.
SNMPLocation="not specified"
SNMPContact="not specified"
SNMPAutLocation="not specified"
SNMPLocation="not specified"
SNMPStation=""

[DCP]
; These variables en/disable the DCP protocol on X120/X127
; and X130, resp.
;InternalDcpEnabled=0
;ExternalDcpEnabled=1

[LLDP]
; These variables en/disable the LLDP protocol on X120/X127
; and X130, resp.
;InternalLldpEnabled=0
;ExternalLldpEnabled=1
```

```
[LinuxBase]
; Keep size of /var/log/messages around this value
; (not followed exactly for performance reasons)
LogfileLimit=102400

; Protocol/Port pairs to open in the firewall
; (e.g., TCP/5900, UDP/514, ...)
;FirewallOpenPorts="TCP/5900 TCP/102"
; If there is only one Ethernet interface, it's used by
; default as an external (company) network. Alternatively,
; usage as automation net (TCU boot support etc.) is possible
; by setting NetworkModel to "automation". (Only NCU, Service
; and PCU20A variants!)
;NetworkModel=automation

; DisableSubsystems can be used to skip certain CFSes (= subsystems)
; a list of multiple names (separated by spaces) is possible
; a simple name means all CFSes with this name, an absolute path
; (e.g.,/siemens/sinumerik/nck) exactly this one CFS with
; the special value "ALL", all subsystems can be disabled
;DisableSubsystems=nck

; Directory for OEM netboot files (served by tftp to diskless clients)
NetbootDirectory=/oem/common/netboot

; Properties of local time zone: names, offset, start and end day
; Some examples:
;  Europe: WET0WEST,M3.5.0,M10.5.0; CET-1CEST,M3.5.0,M10.5.0; EET-
2EEST,M3.5.0,M10.5.0; USA: EST5EDT,M4.1.0,M10.5.0; CST6CDT,M4.1.0,M10.5.0;
MST7MDT,M4.1.0,M10.5.0; PST8PDT,M4.1.0,M10.5.0; China: CST-8; Japan: JST-
9Timezone=UTC
```

```
; If DisablePLCTimeSync is set, no time synchronization with
; PLC will happen
;DisablePLCTimeSync=1

; Set to 1 to enable coredumps in /var/tmp
EnableCoreDumps=0
```

2.4 Service Commands

2.4.1 Using service commands

Overview

The service command 'sc' is a tool used for performing a range of service tasks on a SINUMERIK NCU. The required action is written in the command line after the 'sc', e.g.: sc help

This action produces a list of all actions with a short description. After the action, further parameters or options can follow.

'sc' is available in both the NCU basic system and the service system (mostly in the form of a USB memory.) However, some actions are only useful in one of the two systems (NCU/Service). This is noted for each action.

See also

The most important terms and abbreviations are explained in the glossary.

Privilege levels

The 'sc' command can execute its actions using more privileges than are normally granted to the calling user. For example, starting or stopping subsystems requires root privileges, but 'sc' allows every user who belongs to the ‘service’ group to do this.

Each action of 'sc' is assigned a “privilege level”. This is a user group to which the user must belong in order to execute the action. As the groups are hierarchically nested, members of “higher” groups can also use the action in question. For example, the group 'manufact' is above 'service', which means that members of the group 'manufact' can call all actions that require the privilege level 'service'.

The privilege level that the caller requires is noted for each individual action. The possible levels are (in ascending order):

- none
- operator
- user
- service
- manufact

Example:

An action with the privilege level 'user' can also always be executed by members of the groups 'service' and 'manufact'. Actions with privilege level ‘none’ can be called by all users.

If a user does not have the required privileges, the following error message is output:

```
Action 'ACTION' needs at least GROUP privilege level.
```

2.4.2 Syntax for the Actions

Description

'sc' in the command line is essentially not case-sensitive.

The following entries are therefore interpreted as identical:

sc help show

SC help SHOW

sc HeLp sHoW

In some cases, however, upper/lower case can make a difference, for example in file or user names. This is avoided wherever possible.

The conventions used are as follows:

- Names completely in upper case represent objects to be used depending on the situation.

  Example: `sc help ACTION`

  In this case, ACTION is to be replaced by the action for which you want a description. If written in lower case, however, the entry should be entered as specified.

- Square brackets indicate optional entries.

  Example: `sc help [ACTION]`

  In this case the specification of an action is optional, which means that you can enter an action, but do not have to. Square brackets may also be nested:

  ... [USERNAME[/DOMAIN]] ...

  In this case, USERNAME and DOMAIN are both optional, but you can only enter a DOMAIN if you have also entered the USERNAME.

- Alternatives are separated with '|'.

  Example: `sc start all|system|SUBSYSTEM`

  This means that any of the following commands applies:

  ```
  sc start all

  sc start system

  sc start SUBSYSTEM
  ```

  In the latter case, SUBSYSTEM in upper case can be replaced by a concrete subsystem name.

- As a shortened form, alternatives can also be written in square brackets:

  ```
  sc save [-full|-user] ...
  ```

  Here you can use the option "-full" or "-user", or none at all.

- Options that begin with '-' can always be entered in any order.

  For example, the notation could be interpreted to mean that "-force" must come after "-full" or "-user", but this is not necessarily the case:

  ```
  sc save [-full|-user] [-force] FILENAME
  ```

2.4.3 Generic elements

Overview

This sections describes the syntax elements that are used by several actions.

Permitted interface designations

The names of network interfaces are used by "sc show ip" and "sc enable DHCPSvr", for example.

As the input of an interface is optional, it is always introduced by a '−' character. The '−' is followed by the actual name. In most cases, multiple names are possible for the same interface.

Accepted names are:

System network port:	"X120", "eth2", "tcu", "internal"
Company network port:	"X130", "eth1", "factory", "extern
IBN port:	"X127", "ibn0", "pg"

Permitted subsystem designations

Subsystem names are entered when using "sc enable" and "sc start", for example. In most cases, the name of the subsystem is simply the name of the corresponding CFS, without the path and without the extension ".cfs". For example, for the CFS /siemens/sinumerik/nck.cfs, the relevant subsystem name is simply "nck".

It is also possible to use absolute paths (beginning with /) in a subsystem name. In the example above, you could also use "/siemens/sinumerik/nck" as a subsystem name. The difference between names with and without a specified path is that without the path, all CFS with this name are included, but if the path is specified, only this exact CFS is meant.

Subsystem

A subsystem is a CFS that not only contains a collection of files, but also executes a program, for example, at runtime. To do this, the CFS contains a script that is used to control the starting and stopping of this program.

For this reason, only administrators are permitted to set up NFS file systems, and NFS is usually only implemented in uniformly administrated environments. Exported file systems on the server are addressed directly on the server via their path.

CFS (Compressed File System)

A CFS (file extension ".cfs") is a compressed file system, similar to a zip file. It contains files and subdirectories that look like normal files on the controller at runtime. Files and directories contained in a CFS cannot be changed. They are decompressed at runtime as required.

NFS (Network File System)

NFS is the most common protocol for remote file systems in the world of Unix, and is also available for Windows. NFS is closely based on the Unix privilege model – each time a file is accessed, a UID and GID are supplied which the server then uses to decide whether the operation is permitted. The server relies on the client to provide the correct IDs.

Remote File System

A file system that is contacted over the network. The files are physically located on another computer in the network (the "server"), but appear locally the same as all other files. Operations performed on these files are sent via the network to the server, instead of being executed directly on a local storage medium (such as a hard drive or CompactFlash Card).

As a server usually exports more than one file system, a name for the required file system must also be entered in addition to the name of the server.

SMB (Server Message Block)

SMB is the underlying protocol of MS Windows file systems (also known as drives, releases, shares, etc.). SMB connections are always active in the context of a specific user, who must be known to the server. Exported file systems have a name (release name), by which they can be addressed. The client does not need to know the concrete path on the server.

2.5 Description of the actions

2.5.1 Help

Description

Syntax:	sc help [Action]
Alternative names:	-h, --help
Privilege level:	none

The call of "sc help" without any additional action outputs a list of possible actions with a short description. If you enter an additional action, you receive a more detailed description for this action.

Examples:

```
sc help
All actions:
help [ACTION]
Print help about a specific or list all actions
restart
Reboot the machine
enable hmi|nck|SUBSYSTEM...
enable DHCPSvr -INTERFACE
Enable HMI, NCK, or any other subsystem
[...]

sc help enable
enable hmi|nck|SUBSYSTEM...
DHCPSvr -INTERFACE

Enable subsystem(s), like 'hmi', 'nck', and so on. A subsystem name
is the name of the CFS containing it, without the '.cfs' extension.
This enables all CFSs with that name, but you can also use a full
path (e.g. /siemens/sinumerik/nck) to enable just a specific CFS.
Another form is to enable the DHCP server on a network interface,
for example 'enable DHCPSvr -X120'.
```

2.5.2 Check-cf

Description

Syntax:	sc check-df
Alternative names:	checkcf
Privilege level:	user

With this action, the CF card is checked reading to see whether it contains defective sectors. If errors occur, this is noted in the file /var/log/messages.

2.5.3 Clear

Description

Various actions can be performed with the "clear" command; only the "clear dhcp" command is relevant here.

clear dhcp

Syntax:	sc clear dhcp [-INTERFACE]
Alternative names:	---
Privilege level:	service

This command clears any state of the DHCP server at the specified interface (default setting is the system network) and resets it to its initial state. This means that the Lease data is deleted: all IP addresses are re-assigned in the network and the server forgets having ever seen a master server.

This action is only appropriate on a machine on which the active DHCP server runs.

Note

The clearing of the Lease data does not delete the entire file, but only the data contained therein. This action also increments the version number, so that available standby DHCP servers can also perform the deletion.

2.5.4 Closeport

Description

Syntax:	sc closeport ID
Alternative names:	---
Privilege level:	service

Mode of operation

This command closes a port in the firewall opened previously with the "sc openport" command. This is only necessary when the port is to be closed manually before the time set with "sc openport" expires. Otherwise the port is closed automatically when the port service life expires.

ON parameter is the ID number of the firewall rule output by "sc openport".

2.5.5 Connect

Description

Syntax:	sc connect [-ro] SERVER:/PATH [MOUNTPOINT] sc connect [-ro] [-public] //[USERNAME[/DOMAIN] [%PASSWORD]@]SERVER/SHARE [MOUNTPOINT]
Alternative names:	mount
Privilege level:	none

This action makes a remote file system on a server available on the controller. This is enabled by linking the remote file system to a local directory, known as the "MOUNTPOINT". The files offered by the server are then visible under this directory.

NOTICE
Note that when entering this command, the password appears on the screen in plain text according to the specified syntax. For path names, use the slash “/” and not the backslash “\”.

Supported file systems

Two types of remote file system are supported: Windows SMB and Unix NFS. These two systems have completely different characteristics, particularly in terms of user administration:

- In Windows SMB, you connect to the server as a particular user that the server must recognize. Via this connection, you then access the files as this user, independently of which local user triggers the action.

  This feature means that in SMB systems, you already have to enter a user name, if necessary its domain, and a password at the time of connection.

- In NFS servers, the connection itself does not require a particular user to be entered. Instead, for each file operation, the user who wants to carry out the operation must log on to the server. The server then decides whether or not to permit this. Users are entered using a user ID and group ID, not with names. The server must therefore recognize the corresponding IDs (or permit access for all users.)

  Another type of remote file system that is supported are USB memory devices exported from TCUs (USB Flash Drive). Since these are integrated using NFS, the entries for server and path are similar to those for NFS. However, the TCU names are administrated differently, and the USB memory devices have specific paths that do not physically exist.

Notation of the remote file system

For SMB and NFS/TCU, the file system is entered using different notations:

SMB: //[USERNAME[/DOMAIN][%PASSWORD]@]SERVER/SHARE

The fixed share is: //SERVER/SHARE

The server name can of course also be a numeric IP address. SHARE is the name of the release on the server. Note that the character '$', which often occurs in this type of name, must be preceded by a backslash ('\') in the command line. Otherwise, the system tries to expand a variable.

A user name can also be entered in front of the server name, separated with a '@' character. If necessary, the user name can also be extended by adding '/' followed by the Windows domain to which it belongs. The password belonging to this user is normally queried interactively, so that it is not visible on the screen. ´

For some applications, however, it may be necessary to write the password on the command line. (For example, programs started from WinSCP cannot read from the keyboard.) In this case, you can append an additional '%' character, followed by the password. If this contains any special characters that are interpreted by the shell (<, >, &, ;, ", ', $, (,), |), you should shield these by preceding them with a backslash. Commas in SMB passwords cannot be interpreted.

NFS: SERVER:/PATH

In NFS, entering the user is not required, which just leaves the two components SERVER and PATH. As before, SERVER is the name of the file server. In contrast to SMB, PATH is a path name that exists on the server, and not an arbitrarily assigned name.

The command "sc show drives SERVER" shows the file systems offered by a particular server in the correct notation. For SMB, if required, the user name etc. still need to be added.

After the entry of the remote file system, you can also specify the required directory ('MOUNTPOINT') in which the remote files will become visible locally. This should be an empty directory to which you have write access. If MOUNTPOINT is omitted, 'sc' itself generates a suitable directory. The name is /tmp/drvNN (numbered consecutively), and is displayed when the connection is successful.

The option "-ro" connects the remote file system in read-only mode, which means that you can only read and do not have write access. This can be useful if you want to exclude changes that originate from the controller, or if the server only allows read-only connections.

As explained above, an SMB file system is connected as the specified user. To prevent a third user from executing file operations on the controller in the name of the connected user, the local directory can normally only be accessed by the latter (and all members of the same group).

However, if you do want to make the remote directory available to further local users, you can use the option "-public" to make the MOUNTPOINT belong to the "operator" group, and this access is therefore guaranteed.

2.5.6 Disable

Description

Syntax:	sc disable hmi|nck|SUBSYSTEM ... sc disable DHCPSvr -INTERFACE sc disable DHCPSync [-X120] sc disable IPAlias [-X120] sc disable usb [-MINUTES] all | HOSTS
Alternative names:	---
Authorization level:	service

The "sc disable" command switches the specified subsystems off. These subsystems are then not loaded again at the next restart. You can also switch several subsystems off with a single "disable" command. "hmi", "nck" or any other subsystem names can be used for the subsystems.

Note

The "sc disable" command acts on the parameters in the file basesys.ini, which is in the following directory: card/user/system/etc/basesys.ini

"sc disable IPAlias" deactivates the second alias IP address for the X120 network interface.

See also

Parameters "InternalIP_Alias" and "InternalNetMask_Alias" in the "basesys.ini" file.

Specific subsystems

The name "DHCPSvr" is a special case. This does not switch a normal subsystem on or off, but specifies whether or not a DHCP server should be started on a network interface. The interface is entered in the standard form.

The synchronization of the DHCP server is switched on and off with "DHCPSync". The synchronization is only possible in the system network.

The commands "sc enable" and "sc disable" function by changing certain variables in the file /user/system/etc/basesys.ini. In subsystems, this variable is "DisableSubsystems", in DHCPSvr "DisableDHCPD<INTERFACE>".

USB memory devices are inhibited with "sc disable USB": Specifically, the devices of USB class "storage" are involved, i.e. input devices can still be operated at the USB interface.

- If a time is not specified [-MINUTES], than a permanent inhibit is set. When a time is specified, the inhibit is specified in minutes.
- The inhibit can refer to all network participants of the plant network or a list with host names or IP addresses can be specified, for which the inhibit is valid.

2.5.7 Disconnect

Description

Syntax:	sc disconnect MOUNTPOINT
	sc disconnect all
Alternative names:	umount, unmount
Privilege level:	user

The action "disconnect" terminates the connection to a remote file system previously connected using "connect“. If the MOUNTPOINT has been automatically created by 'sc', the corresponding directory is also deleted again.

The variant "sc disconnect -all" can be used to remove all existing SMB and NFS file systems.

2.5.8 Distribute

Description

Syntax:	sc distribute [parameter]
Alternative names:	dist
Privilege level:	service

This command distributes TCU data to other machines in the system network. Only the parameter "tcudata" is relevant here.

distribute tcudata

Syntax:	sc distribute tcudata
Alternative names:	---
Privilege level:	service

This command informs the active DHCP server that TCU data in /user/common/tcu has been manually changed. The server can then distribute this data to the standby servers.

It is recommended that the version file in /user/common/tcu be changed manually as this is only read in once by the DHCP server at the start. An incrementing of the version would then only take effect at a restart.

Note

This command can be performed on any machine in the system network, not only on the active server. A message is always sent to the active server.

2.5.9 Enable

Description

Syntax:	sc enable hmi|nck|SUBSYSTEM ...
	sc enable DHCPSvr -INTERFACE
	sc enable DHCPSync [-X120] [-PRIORITY]
	sc enable IPAlias [-X120] IPADDR[/NETMASK]
	sc enable usb [-MINUTES] all | HOSTS
Alternative names:	---
Authorization level:	service

The "sc enable" command switches on the specified subsystems such that these are also activated when a subsystem is started. You can also switch several subsystems on with a single "enable" command. "hmi", "nck" or any other subsystem names can be used for the subsystems.

Note

The "sc enable" command acts on the parameters in the file basesys.ini, which is located in the following directory: card/user/system/etc/basesys.ini

"sc enable IPAlias" defines a second alias IP address for a network interface. This is only supported for X120. The IP address itself has the usual notation with four numbers separated by decimal points. If not specified, the subnet screen form can be determined from the class (A/B/C) of the IP or determined explicitly. The CIDR notation (number of bits of the network section) is also possible.

See also

Parameters "InternalIP_Alias" and "InternalNetMask_Alias" in the "basesys.ini" file.

Specific subsystems

The name "DHCPSvr" is a special case. This does not switch a normal subsystem on or off, but specifies whether or not a DHCP server should be started on a network interface. The interface is entered in the standard form.

The commands "sc enable" and "sc disable" function by changing certain variables in the file /user/system/etc/basesys.ini. In subsystems, this variable is "DisableSubsystems", in DHCPSvr "DisableDHCPD<INTERFACE>".

With "sc enable usb" USB storage devices at permanently inhibited USB interfaces or at specific host names or IP addresses will be released again.

DHCP synchronization

The synchronization of the DHCP server is switched on and off with "DHCPSync". The synchronization is only possible in the system network (X120). A priority can also be specified. -LOW, -HIGH or -MASTER.

The priorities have the following effect for the synchronization of the DHCP server:

- **MASTER:** The computer node will become an active DHCP server. If several servers have been configured in the system network, this computer has the highest priority.
- **HIGH:** The computer node belongs to the server candidates with high priority, i.e. if no server with "MASTER" priority becomes active, then a computer with "HIGH" priority can be the active server.
- **LOW:** The computer node belongs to the server candidates with low priority, i.e. if no server with "MASTER" priority or "HIGH" priority becomes active, then a computer with "LOW" priority can be the active server.

Note

Recommended settings are:

- DHCP operation and DHCP synchronization are switched on in the system network.
- **Exactly one** NCU is set as DHCP server.
- **Maximum of two** computers are candidates with "HIGH" priority.
- All other components are set as DHCP clients or candidates with "LOW" priority.

See also

Parameter "SyncModeDHCPD_SysNet" in the "basesys.ini" file.

2.5.10 Openport

Description

Syntax:	sc openport [-MINUTES] PROTO/PORT SOURCE ...
Alternative names:	---
Authorization level:	service

Mode of operation

This command opens a port in the firewall to the company network (X130) for a certain time. The default time is 15 minutes, but this can be changed with the -MINUTES option. The maximum possible time is 60 minutes.

The port to be opened is specified in the form "PROTO/PORTNR". The protocol can be either "tcp" or "udp". This is followed by the specification of the hosts from which the port should be accessible. Several forms are possible here:

- A single IP address: "128.128.12.12"
- A host name (if this can be resolved via DNS), e.g. "server"
- An IP area with network screen form specification, e.g. "128.128.12.0/255.255.255.0"
- An IP area with specification of the valid bits, e.g. "128.128.12.0/24"

If the specification of the source host is completely missing, this is normally acknowledged with an error message. However, an exception is when the "sc openport" command is entered in a shell opened via SSH. The permitted host is taken from the environment variable $SSH_CLIENT that contains the IP of the SSH client.

If the opening was successful, an ID number is output in a status message:

```
sc: Port tcp/25 is open, rule ID is 6620
```

This ID can be used with "sc closeport" to manually close the port earlier.

NOTICE
Security
Note that opening the ports in the firewall can represent a security risk. Only enable the ports that you actually require.
Note that every accessible service can have security gaps.

See also

Parameter "FirewallOpenPorts" in the "basesys.ini" file.

2.5.11 Port status

Description

Syntax:	sc portstatus [-x127] PORTSPEC SOURCE
Alternative names:	---
Authorization level:	service

Mode of operation

The command "sc portstatus" can be used to query whether a certain port in the firewall has been opened. Option "-x127" must be specified if X127 is intended as the firewall instead of X130. The port specification looks exactly the same as it does for "sc openport", e.g. "tcp/102". However, at this point, no names are permitted and the specified source-IP must be unique.

The following status is output:

- "Port not open" with exit status 1.
- "Port is open (rule ID is <N>)." and exit status 0.

  The ID is also supplied which you must specify for "sc closeport".

2.5.12 Restart

Description

Syntax:	sc restart all|system|network| [!]SUBSYSTEM
Alternative names:	reboot
Authorization level:	service

With the action "sc restart" the specified subsystems are first stopped and then restarted with the following secondary condition: Dependent subsystems are also restarted with a restart.

Syntax

'hmi', 'nck' or any other subsystem names can be used for the subsystems. Several subsystems can also be specified one after the other, which are then started or stopped – including all of the required dependencies. It is also possible to start and stop all subsystems with the exception of those specified. To do this you write an exclamation mark "!" in front of the list.

"all", "system" and "network" are special values for the subsystem:

- "all" stops and starts all available subsystems.
- On the other hand, "sc restart system" initiates a system restart (reboot)
- "network" can only be specified in conjunction with "restart". "sc restart network" reinitializes the network, e.g. after settings have been changed in basesys.ini.

Examples

```
# stop all subsystems:
$ sc stop all
# only stop HMI:
$ sc stop hmi
# start HMI and NCK:
$ sc start hmi nck
# start all subsystems except NCK
$ sc start ! nck
```

2.5.13 Restore

Description

Syntax:	sc restore [-full|-addon|-addon+|-oem|-oem+|-user] [-force] [-nodelete] [-update] [-restart] FILENAME
Alternative names:	---
Authorization level:	user

A backup created using "sc save" can be restored to the controller using "sc restore".

Mode of operation

As for "sc save", a restore is only possible from the service system or if subsystems are stopped. If “sc restore" reports an error, for example that the restore will cause running subsystems to crash, you can use the option "-force" to force the operation – just as for “sc save”.

Normally, "sc restore" deletes the whole target area before the backup is restored (complete CompactFlash card for full backup, /user in user data backups). This means that no files not included in the backup are subsequently available.

Archive and backup files larger than 4GB

If a backup is to be restored with "sc restore" - consisting of several archive files - only the first file of the backup must be specified in the FILENAME parameter. Once the end of the file has been reached, other parts will be searched automatically.

Decisive when determining the continuation files is the format of the file name which was transferred during calling, i.e. when calling "sc restore /tmp/backup.01of02.tgz", and after reaching the end of "/tmp/backup.01of02.tgz" the search is on for the next file "/tmp/backup.02of02.tgz". When calling "sc restore /tmp/backup.1of2.tgz", file "/tmp/backup.2of2.tgz is expected correspondingly as a second part of the backup.

Options

If no further options are specified, the archive should represent a full backup and this should be restored in full. The status of all files is therefore the same after the "restore" as it was at the time of the backup.

- The -full option additionally forces the partition and the file system to be recreated on the CF card. This is, however, only possible from a service system. -full is necessary if the partition table and/or file system is missing or damaged.
- However, if you want to restore the backup files without losing any files that have been created in the meantime, you can use the option "-nodelete" to prevent these from being deleted. "-nodelete" is not executed together with "-full", as when the file system is recreated, all files are essentially deleted.
- The options -addon, -oem, -user, -addon+ and -oem+ also allow you to unpack only parts of an archive.
- The -update option is used for loading software updates supplied by Siemens. The -restart option can also be useful with -update. If user-defined system files are changed when loading an archive, a restart or reinitialization is necessary. In such cases, "sc restore" outputs a message to that effect at the end of the operation. The -restart option causes the required action to be performed automatically.

2.5.14 Save

Description

Syntax:	sc save [-full|-addon|-addon+|-oem|-oem+|-user] [-force] [-update] FILENAME
Alternative names:	backup
Authorization level:	user

The call of "sc help" without any additional action outputs a list of possible actions with a brief description. If you enter an additional action, you receive a more detailed description for this action.

The action "Save" or “Backup” creates a backup of the CF card in FILENAME. If the action is used from a service system, the backup receives the files of the underlying controller, not of the service system itself.

Archive and backup files larger than 4GB

If the Backup is written on a FAT32 target file system, no file size of more than 4GB is permitted, then the Backup is divided into several files, which are correspondingly smaller than this threshold value.

In the target file names, which are indicated during the call of"sc save", an indication is given in this case which part of a number of backups it is and of how many files it consists: The call of "sc save /tmp/backup.tgz" thus generates, for example, the files "/tmp/backup.01of02.tgz " and "/tmp/backup.02of02.tgz ".

Options

The following options are used for selecting which directories of the file system are to be written to the archive:

-full:	complete backup (default): all files of the controller, incl. Boot Loader
-addon:	only /addon directory
-oem:	only /oem directory
-user:	only /user directory (user data)
-addon+:	/addon, /oem and /user
-oem+:	/oem and /user

If "sc save" is used directly on the controller and the subsystems are running, this may lead to inconsistencies between saved files, because they can still change during the backup process. Therefore, in this case “sc save" normally ends in an error message to inform you that subsystems are still running.

- If you want to create a backup anyway, you can use the -force option. "sc save" still issues a warning, but the process continues. If "sc save" is started from the service system, no subsystems of the controller are running and "-force" is not necessary.
- The -update option writes an Img-D control file to the archive. This makes it possible to use the archive at a later date via "sc restore -update".

Example:

```
sc save -user /tmp/drv01/backup.tgz
```

2.5.15 Show

Description

Syntax:	sc show ip [-INTERFACE]
Alternative names:	----
Authorization level:	none

In the "sc show" command, various displays are grouped together showing the status of the system.

show ip

Syntax:	sc show ip [-INTERFACE]
Authorization level:	none

This command displays the IP address data of network interfaces. You have the option to enter a specific interface. If no particular interface is specified, the data for all existing interfaces is displayed, as well as the Default Gateway.

Example:

```
sc show ip
X120 (system network, eth0):
   configured: (default)
   current : IP=192.168.214.1 Netmask=255.255.255.0
MAC=08:00:06:73:55:fd
   DNS Name  : ncu1.local
   Nameserver: 127.0.0.1
   DNS suffix: local
   DHCP      : synced server, prio=high, active
   Statistics: RX=0.0MB (0.00% errors), TX=0.2MB (0.00% errors)
X130 (company network, eth1):
   configured: DHCP
   current   : IP=111.222.333.64 Netmask=255.255.248.0
MAC=08:00:06:73:55:fe
   DNS Name  : name.test.siemens.de
   Nameserver: 111.222.333.12 111.222.333.13 111.222.333.14
   DNS suffix: test.siemens.de
   DHCP      : client (server: 111.222.333.221)
   Statistics: RX=1.2MB (0.00% errors), TX=0.0MB (0.00% errors)
X127 (engineering network, ibn0):
   current   : IP=192.168.215.1 Netmask=255.255.255.224
MAC=08:00:06:73:55:ff
   DNS Name : ncu-ibn
   DHCP      : server
   Statistics: RX=0.0MB (0.00% errors), TX=0.0MB (0.00% errors)
Default gateway: 111.222.333.1 (via eth1)
Used nameserver: 127.0.0.1
Used DNS suffix: test.siemens.de local
```

The following data is displayed for each interface:

- **Name:** the name of the connection socket (X1_ _), together with the name used by the operating system in brackets (ethN or ibnN).
- **"configured":** the IP address configured in the basesys.ini (variables ExternalIP/ExternalNetMask for X130, InternalIP/Internal-NetMask for X120), or "(default)" if nothing is configured in the basesys.ini, or "DHCP" if the address was sourced via DHCP.
- **"current":** the currently set IP address together with the network screen form and MAC address of the interface.
- **"DNS Name":** Result of a DNS reverse lookup on the current IP address.
- **"Nameserver":** Here the list of DNS servers is output which are related to this interface (receive e.g. DHCP via this interface).
- **"DNS Suffix":** DNS search suffix related to this interface.
- **"DHCP":** Indication is given here if a DHCP client or server is running for this interface. In the case of a client, the server where the IP address comes from is displayed, too. A DHCP server on X120 can additionally be synchronized on the system network. Then the information is displayed if this is the active server or if it is in standby mode.
- **"Statistics":** Total amount of data received or sent via this interface, and the percentage of faulty packages.

When all interfaces are displayed, the default gateway is also output, i.e. the address of a router to which all packages are sent that cannot reach their destination directly via a local interface.

The default gateway is therefore a piece of data that applies to all interfaces and of which there is only one instance. However, there is one interface via which it must be possible to address the default gateway. This is displayed in brackets after the address.

show drives

Syntax:	sc show drives SERVER
Authorization level:	none

"sc show drives" shows the available remote file systems for a particular server. The server name SERVER can be an NFS server or a "TCU", which represents any USB media that are connected to a TCU. For details of possible server names and entering a user name (often required for SMB), see the description of the "sc connect" command.

Examples

Notation:

```
sc show drives someuser/somedomain@somepc # Windows-Server
Password: *******
//somepc/C$
//somepc/D$
//somepc/images
sc show drives someserver # NFS-Server
someserver:/export/home1
someserver:/export/home2
sc show drives TCU # TCU USB-Medien
TCU1:/dev0-0
TCU2:/dev0-0
```

All the available remote file systems of the relevant server are listed in the notation that is expected by "sc connect".

- In NFS file systems, the server name is always first, followed by a colon and then the export path.
- A USB memory on a TCU is a special form of NFS, and therefore also has the same notation as an NFS file system. The specified path exists - but not physically - on the TCU, but is converted there to USB by the NFS server.

show net

Syntax:	sc show net [-xml] [-hw|-tco|-sw|-swfull|-loc|-panel|-dhcp|-switch|-all] [HOSTS...]
Authorization level:	none

The "sc show net" command displays the devices in the system network and gives additional information on these devices.

As both these functions rely on SNMP (Simple Network Management Protocol), only those devices able to use SNMP will be found. SNMP as from version 2.6 is available for Linux-based devices, for all other devices (e.g. MCP) this depends on the respective software version. If a simple call is made, without any additional options, a list of the devices found will appear showing the relevant IP address, DNS name (if known), and a short description (module name).

Options

The various switches, which can also be combined, allow additional information to be output on the devices found:

- Unless additional options are involved, the output format for "sc show net" is designed to be displayed on the screen. The alternative XML format is preferable, however, if further machine-based processing is required. This can be selected via the -xml option (this option must be the first one!).
- If the command line contains nothing after the switches, "sc show net" will search the entire system network by broadcast for devices able to use SNMP. This search takes time, however, and in the case of larger systems, the volume of information output may be considerable. In view of this, a list of IP addresses or (DNS) names can be specified to ensure a better overview. This will limit the search process and only the named devices will be included.

-hw	Information on hardware, such as the MLFB, serial number, hardware ID, hardware version, SRM version, manufacturer, and the serial number of the CF card. Some devices have two of these hardware blocks (the second one being intended for an integrated device). The PLC in the NCU and the TACO in the OP on an TCU are two such examples.
-tco	Operating state data: switching counter, operating hours counter, quantity of data written to the CF card, number of times maximum temperature exceeded
-loc	Location data: location, function, and contact details for the device (if configured there)
-sw	Displays brief details of the software installed, just the version of the overall status (or of the basic system, if this is all that is installed)
-swfull	Displays all the installed software components. These are represented hierarchically in the form of a tree. The following is provided for each component: information on the version, internal version (if different), target version (if different), version details, and the installation path.
-panel:	Displays panel-specific data: size and color depth of the display, MCP/TCU/DCK/EKS index, and the VNC server currently represented
-dhcp	Data on a synchronizing DHCP server: operating state (off/standby/active), priority, versions of the .leases file and TCU data, and the range for dynamically assigned IP addresses
-switch	Displays the settings of rotary switches on the device, e.g. the NC and PLC switches of an NCU or the DIPFIX of an HT 8
-all	Equivalent to all the switches above

Note

EUNA (End User Notification Administration)

The data and information read out here is written to the EUNA file and saved on the respective device.

2.5.16 Start, Stop

Description

Syntax:	sc start all|system|SUBSYSTEM
	sc start all|system|SUBSYSTEM
Alternative names:	---
Privilege level:	service

These two actions start or stop individual or all subsystems. Since these actions have a direct influence on the runtime behavior, they are only available directly on the PLC, but not in the service system (with the exception of "sc stop system"). The subsystems of the underlying PLC do not run here, and can therefore not be controlled.

Note

Only "all" and "system" function, but not arbitrary subsystems.

Both of these actions have only been implemented to a restricted extent.

Subsystem names

"hmi", "nck", or any other names, can be used for the subsystems. Multiple subsystems can also be specified in a row, which are then started and stopped in this order.

"all" and "system" are special values for the subsystem:

- "all" starts or stops all available subsystems.
- "sc stop system" similarly stops all subsystems, but also the basic system with the PLC.
- "start system" is identical to "start all" and exists mainly for reasons of symmetry.

start snc

Syntax:	sc start snc
Alternative names:	---
Privilege level:	service

This command starts the "System Network Center". To operate it, you will need a mouse.

The "System Network Center" you can end with "Exit". If you do not wish to end the "System Network Center", then switch to the HMI with the following key combination:

<Recall> + <MENU SELECT> (Area switchover key) or

<F9> + <F10> on an external keyboard

Reference

A description of the settings in the "System Network Center" is provided in the Operating Components and Networking Manual.

Service and diagnostics 3

3.1 Creating a service system

Overview

To **backup** user data or the complete CompactFlash Card, proceed as follows:

- Creating a service system.
- Backing up the license
- Backup: Data backup on USB storage medium or on a network drive.
- System diagnostics
  - Output network settings
  - Changing the network settings
  - Starting the VNC Viewer

To **restore** the user data or the complete CompactFlash Card, proceed as follows:

- Restore/Recover: Restore the data from USB storage medium or from network drive.
- Carry out software update.
- Carry out firmware update.

3.1.1 How do you create a service system for the NCU?

Purpose

In case service is needed, create a portable "Emergency Boot System" (EBS) on a USB memory. Thus you can start the booting of the NCU from the service system in order to carry out various service tasks, such as data backup or updates, in a service shell.

Two partitions are created on the service system:

- A Linux partition that is not displayed under Windows.
- An FAT partition, to backup files or save software updates.

  The FAT partition can be read and written to under Linux as well as from a Windows system. The FAT partition can be addressed under the path/data in a command shell under Linux.

Scope of delivery

To create a service system on a USB storage medium, the following files are included on CD:

- an executable file installdisk.exe
- an image file for USB-FlashDrive
- a file with the latest information siemensd.txt / siemense.txt

Recommendation:

It is better to use SIMATIC PC USB-FlashDrive.

Note

To create the service system, you need administrator rights.

All data already on the USB storage medium will be deleted.

The transfer is optimized for USB 2.0; therefore, the transmission to the USB storage medium takes longer when using USB 1.1 than USB 2.0

Proceed as follows

To create a service system on a USB storage medium:

1. Copy the service system onto a local hard disk of your PG/PC.
2. Connect the USB storage medium to the USB interface of the PG/PC.
3. Determine in Windows Explorer which drive letter the USB storage medium was assigned, e.g. H:
4. Open a DOS shell and change to the directory in which the files for the service system are stored.
5. In the DOS shell, enter the following command:

```
installdisk --verbose --blocksize 1m linuxbase.img h:
```

Result: The image is transferred to the USB storage medium.

3.1.2 This is how you operate the service system

Connecting-up the service system

Procedure:

1. Connect the USB storage medium to the USB interface X125 or X135 of the NCU.
2. Switch-off the system and then switch on again.

   OR

3. Press the "Reset" button.

   The service system is unzipped from the USB storage medium when the NCU boots for the first time: Only then can the USB storage medium be used as service system and the entire storage capacity is available.

Operating the service system

Keys and softkeys to navigate in the service system:

Softkey	Key on OP	External keyboard	Description
↓	HSK1	<F1>	Moves the cursor down a row
↑	HSK2	<F2>	Moves the cursor up a row
Page↓	HSK3	<F3>	Moves the cursor down a page
Page↑	HSK4	<F4>	Moves the cursor up a page
Char↓	HSK5	<F5>	Inserts text or digits
Char↑	HSK6	<F6>	Inserts text or digits
Cancel	VSK7	<Shift> + <F7>	Cancel / Return
Ok	VSK8	<Shift> + <F8>	OK / Confirm
---	NEXT WINDOW	Pos1	Moves the cursor to the top row
---	END	End	Moves the cursor to the bottom row

Note

Operation on touch panels

No touch operation is supported by the service system

- SINUMERIK OP019: An external keyboard is required for text input (connected via USB).
- SIMATIC Thin Client Here, you can activate the integrated keyboard.

3.1.3 Diagnostics functions

Functions of the service menu

The following functions for service and diagnostics are available on the service system:

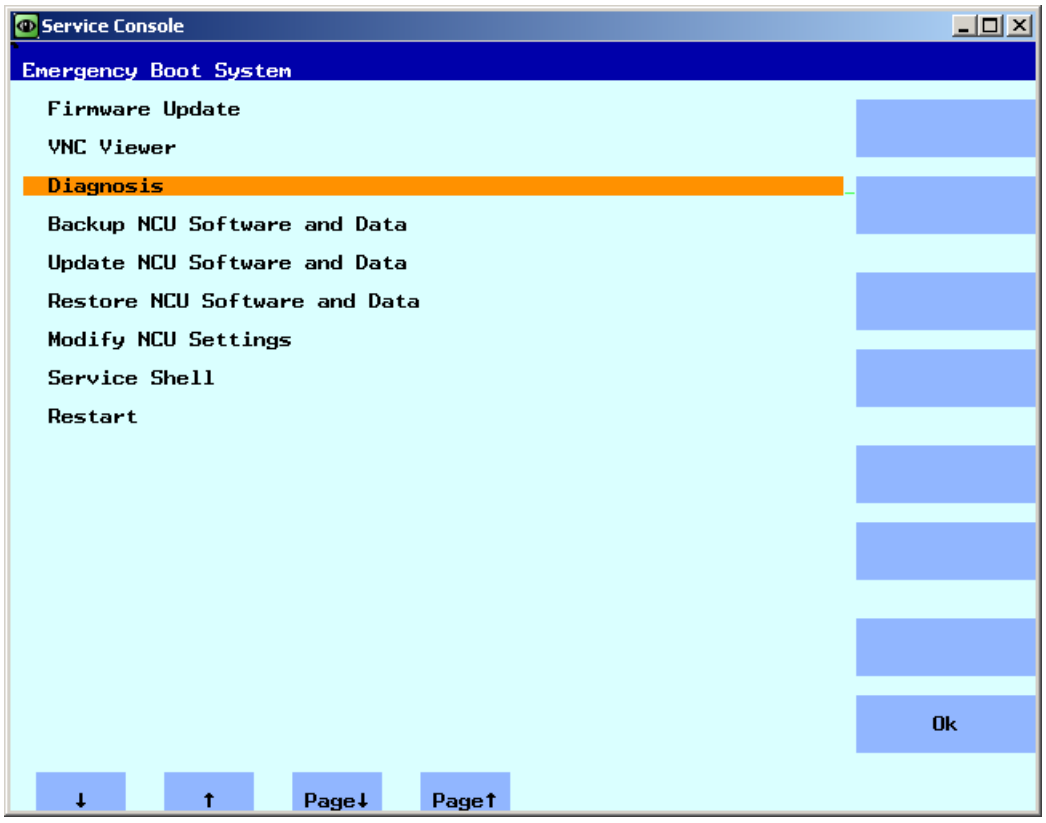

Figure 3-1 Service menu

Overview of the main menu:

Main menu	Description	Reference to chapter/manual
Firmware Update	Update BIOS: • PLC BIOS • FPGA • CBE30 Bootloader	This is how you update the firmware (Page 78)
VNC Viewer	Start a VNC Viewer	Calling the VNC Viewer (Page 87)
Diagnosis	Starting a diagnostic function to display network-connection data and data on the system CompactFlash Card.	Performing system diagnostics (Page 82)
Backup NCU Software and Data	Backup system and user data on the USB FlashDrive or network drive.	Backup data via the service menu (Page 66)
Update NCU Software and Data	Upgrade the system from the USB FlashDrive or network drive.	This is how you update the software (Page 80)
Restore NCU Software and Data	Restore system and user data from the USB storage medium or network drive.	Backup data via the service menu (Page 66)
Modify NCU Settings	• Change network settings • Activate/deactivate HMI • Restore delivery condition of the following components: – HMI – NCK – PLC – Drive	This is how you change the system settings (Page 84)
Service Shell	A Service Shell is opened in order to input service commands.	Backing up data via the service shell (Page 73) Service Commands (Page 34)

3.1.4 This is how you connect to a network drive

Connecting network drives

1. Select "Connect to network drive".
2. Enter the complete path name of the network drive.
3. Register yourself with a user name with access authorization to this drive.

   Note the syntax of the examples specified:

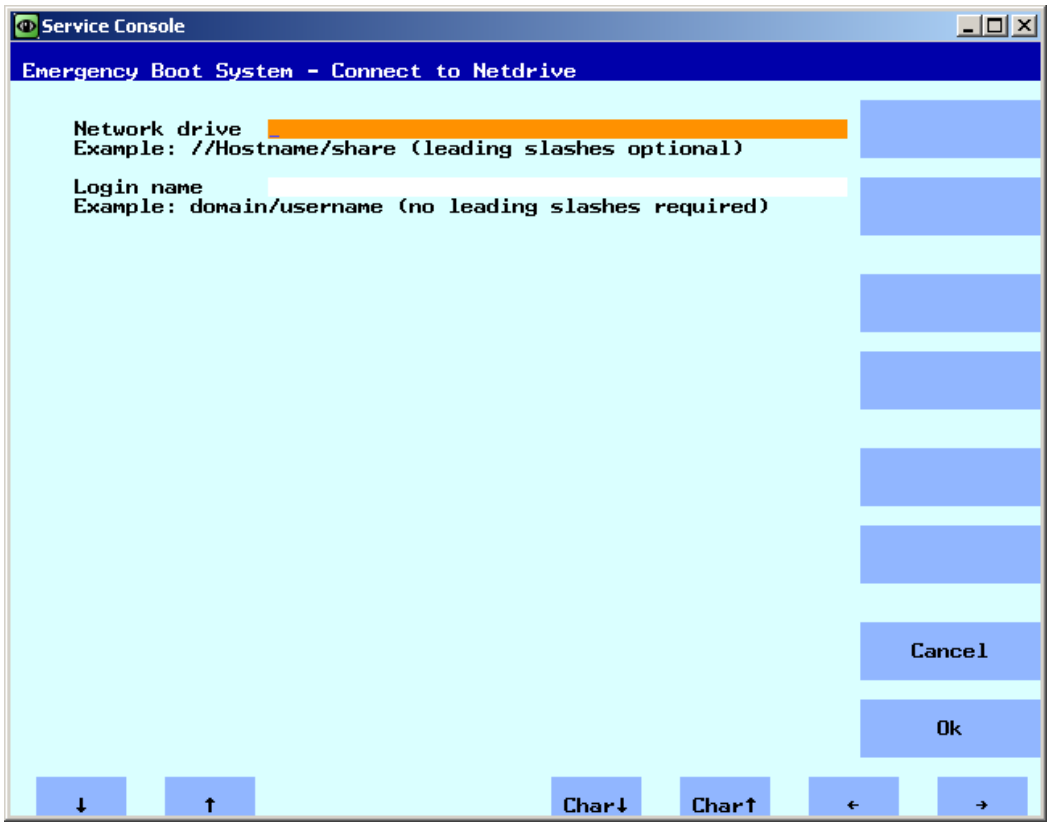

Figure 3-2 Connecting network drives

4. Confirm with "Ok". You are then prompted to enter a password.

3.2 Backup license

Validity of the license key

The license key corresponds to the serial number of the CompactFlash Card. If the CompactFlash Card is replaced for a SINUMERIK 840D sl, the license key loses its validity and the system is no longer ready for operation.

This situation can occur for a defective hardware of the system CompactFlash Card.

Application

For the following cases, backup the license key of the CompactFlash Card on a USB storage medium or on a network drive:

- Software update without license key
- System software error without defective hardware

NOTICE
Replacement CompactFlash Card The following data are required in order to obtain a valid license key after replacing the system CompactFlash Card: **The serial number of the defective and the new** CompactFlash Card.

3.2.1 This is how you backup the license key

Backing up the license key on a USB storage medium

Procedure:

1. In the main menu, select the menu item "Backup NCU Software and Data".

   The following menu is displayed:

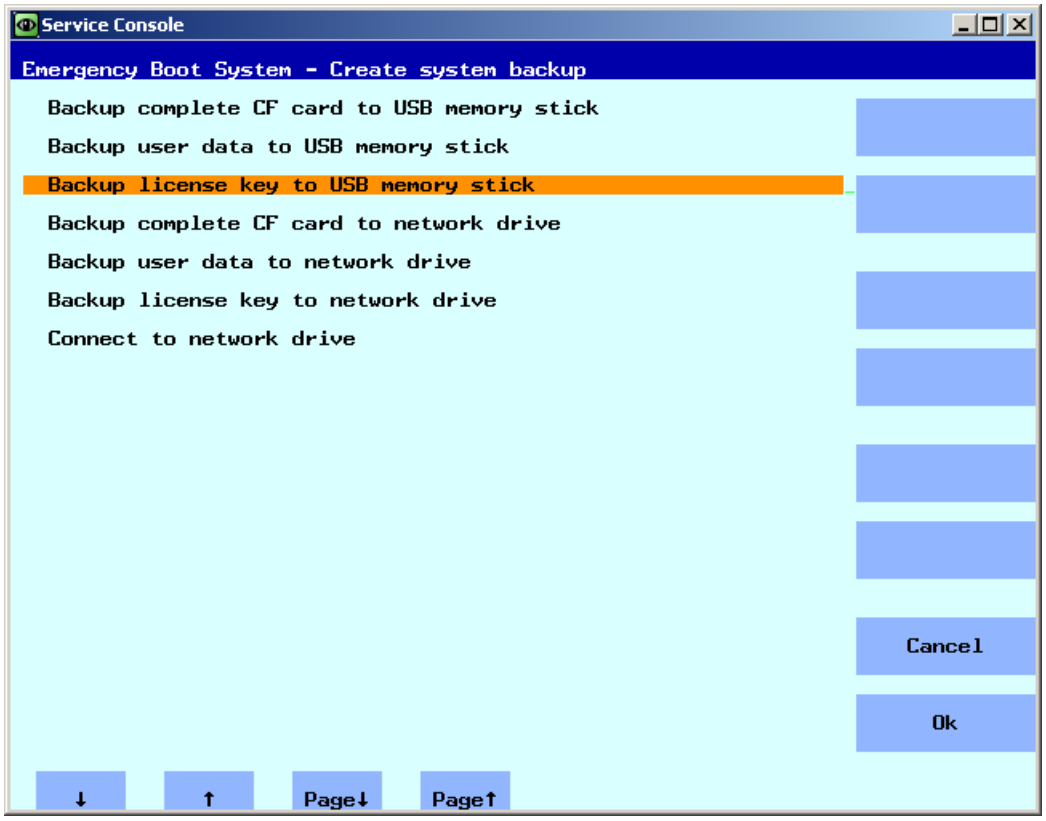

Figure 3-3 Backing up licenses

2. Select the menu item "Backup license key to USB memory stick".

   The following menu is displayed:

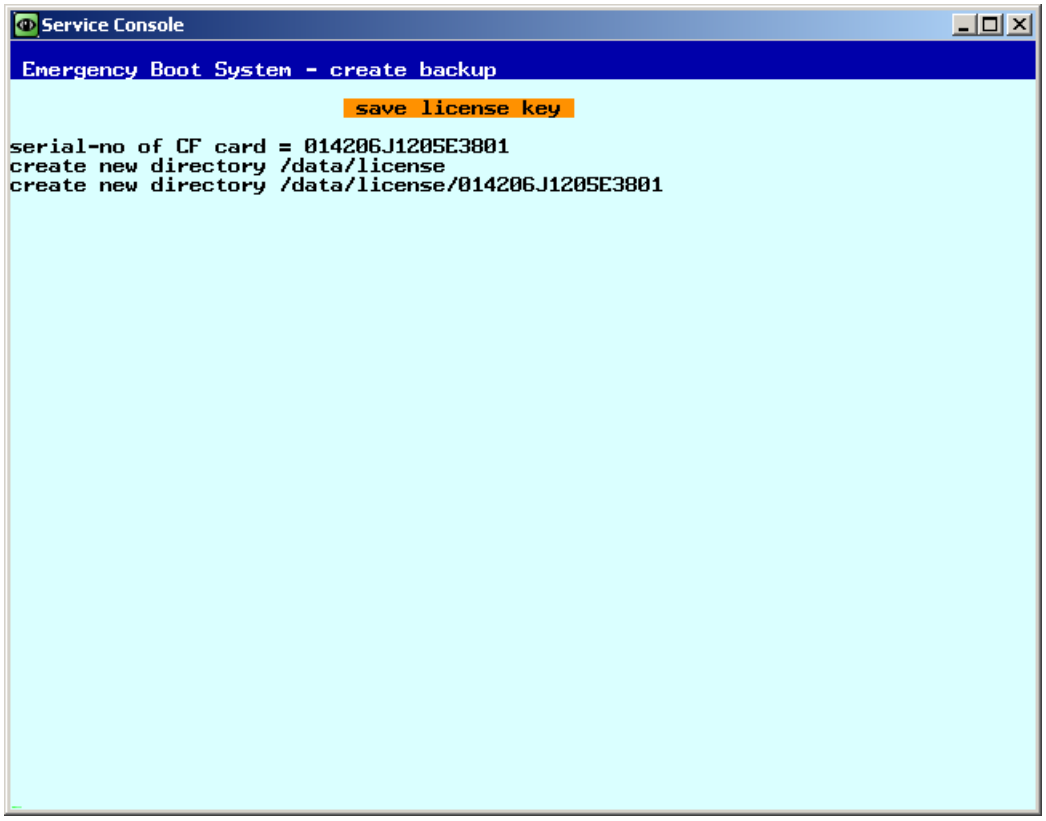

Figure 3-4 Save license key

The license key is backed up in the specified directory together with the serial number of the CompactFlash Card.

See also

The procedure is essentially the same as for "Backup license key to network drive". In addition, you connect to a network drive:

This is how you connect to a network drive (Page 62)

3.3 Backup data via the service menu

3.3.1 This is how you backup user data

Backing up and restoring user data

Procedure:

1. In the main menu, select the menu item "Backup NCU Software and Data".
2. Select "Backup user data to USB memory stick" and confirm with "Ok".
3. Enter a complete file name - as shown in the example:

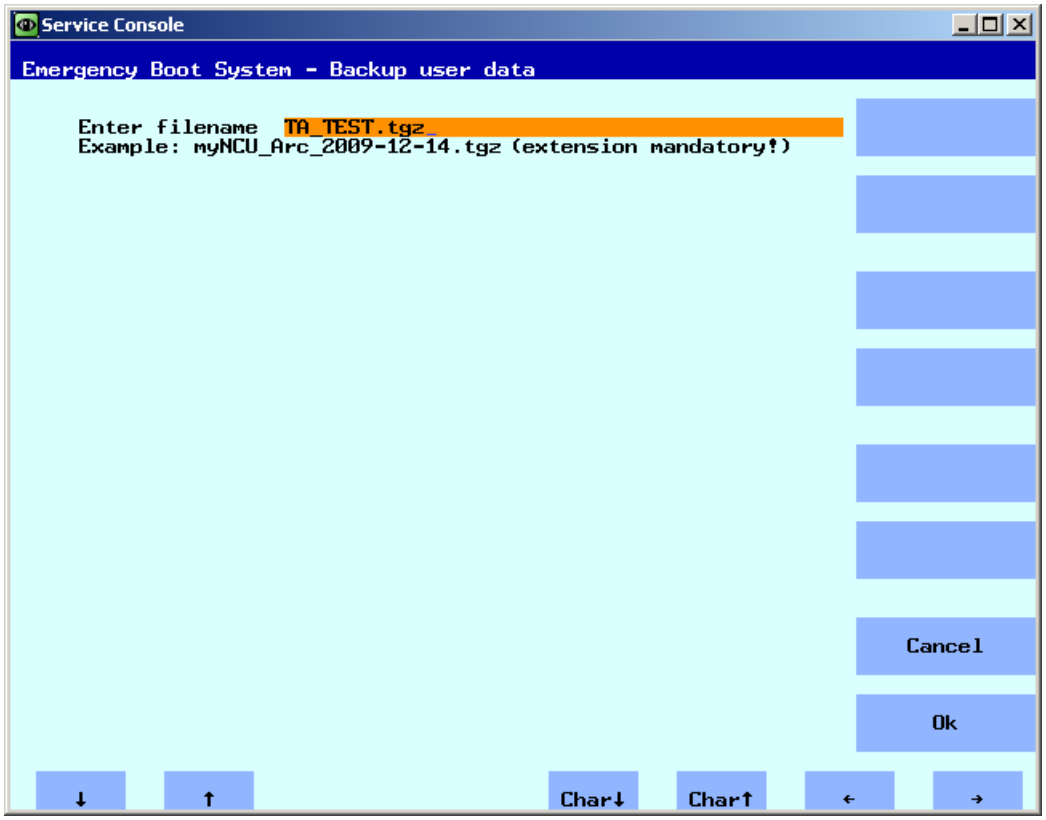

Figure 3-5 Entering a file name

4. Confirm with "Ok". The following message is output after the operation has been successfully completed:

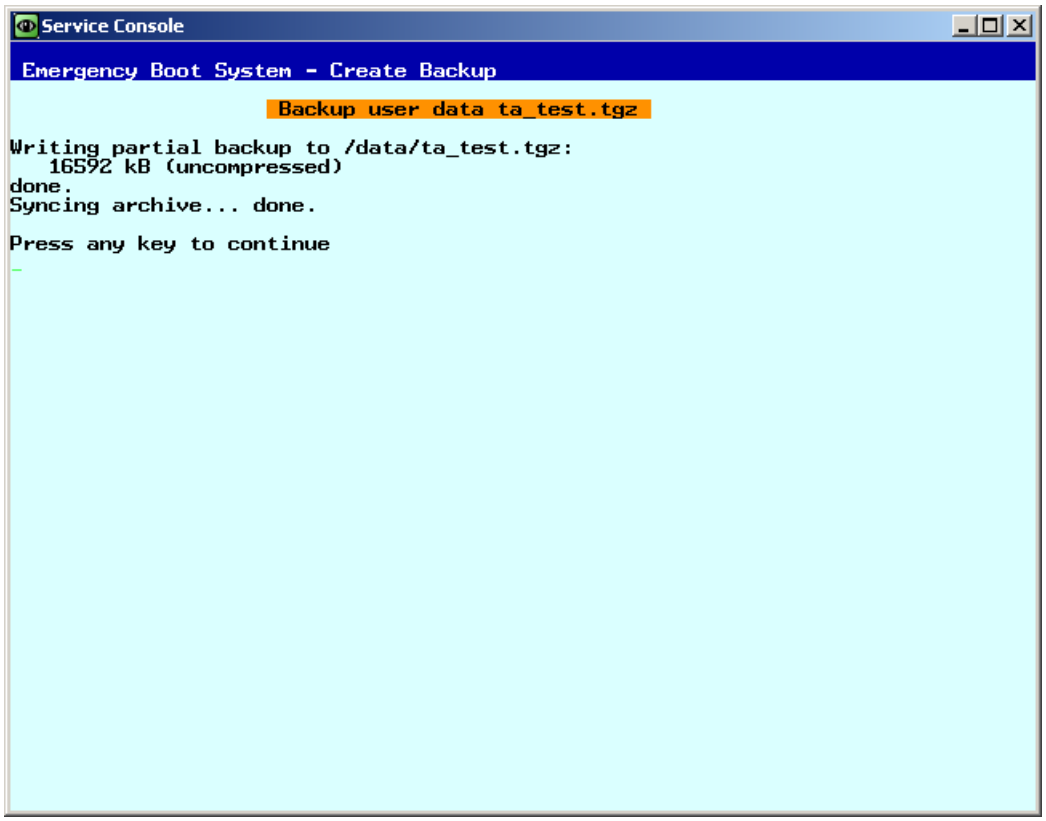

Figure 3-6 Operation completed

Note

Backup file ≥ 4GB

For a backup file ≥ 4GB, the space on the FAT partition of the service system (with 8GB) is no longer sufficient. For this reason, backup files of this size are partitioned (see also: sc save/sc restore) or they can be saved on a network drive.

See also

The procedure for "Backup user data to network drive" is analog. In addition, you connect to a network drive:

This is how you connect to a network drive (Page 62)

3.3.2 This is how you restore user data

Restoring user data

Procedure:

1. In the main menu, select the menu item "Restore NCU Software and Data".

   The following menu is displayed:

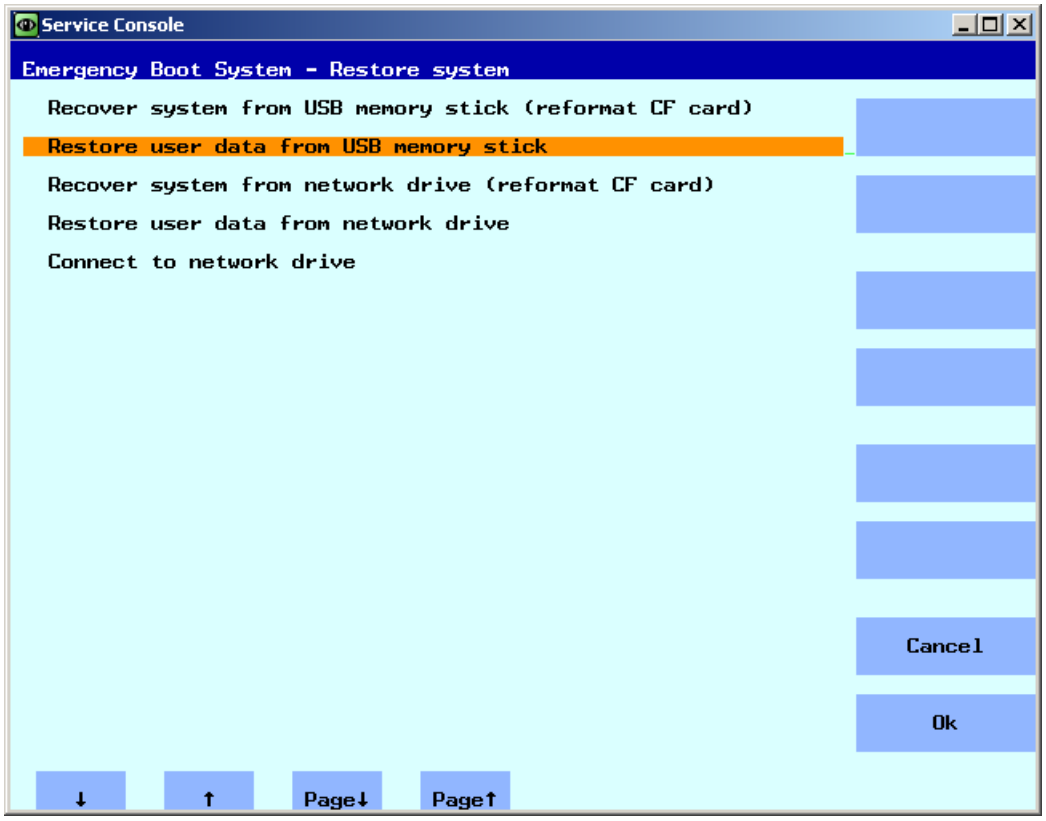

Figure 3-7 Restoring user data

2. Select "Restore user data from USB memory stick" and confirm with "Ok".

   The list of the tgz files available on the USB storage medium are displayed.

3. Select the appropriate tgz file and confirm with "Ok".

   A message is output after the operation has been successfully completed.

See also

The procedure for "Restore user data from network drive" is essentially the same. In addition, you connect to a network drive:

This is how you connect to a network drive (Page 62)

3.3.3 This is how you create a complete backup of the CompactFlash Card

Creating a complete backup

Procedure:

1. In the main menu, select the menu item "Backup NCU Software and Data".

   The following menu is displayed:

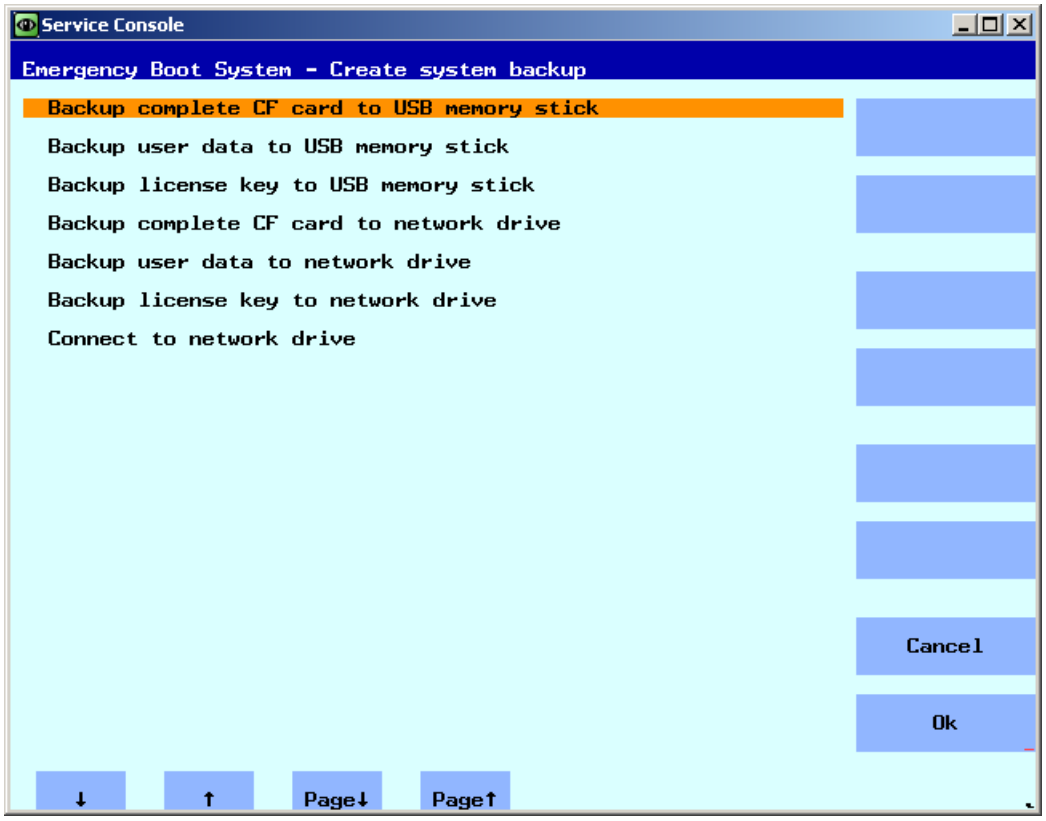

Figure 3-8 Backup up

2. Select "Backup complete CF card to USB memory stick" and confirm with "OK".
3. Enter a complete file name - as specified in the example.

4. Confirm with "OK". This can take several minutes.

   The operation is displayed:

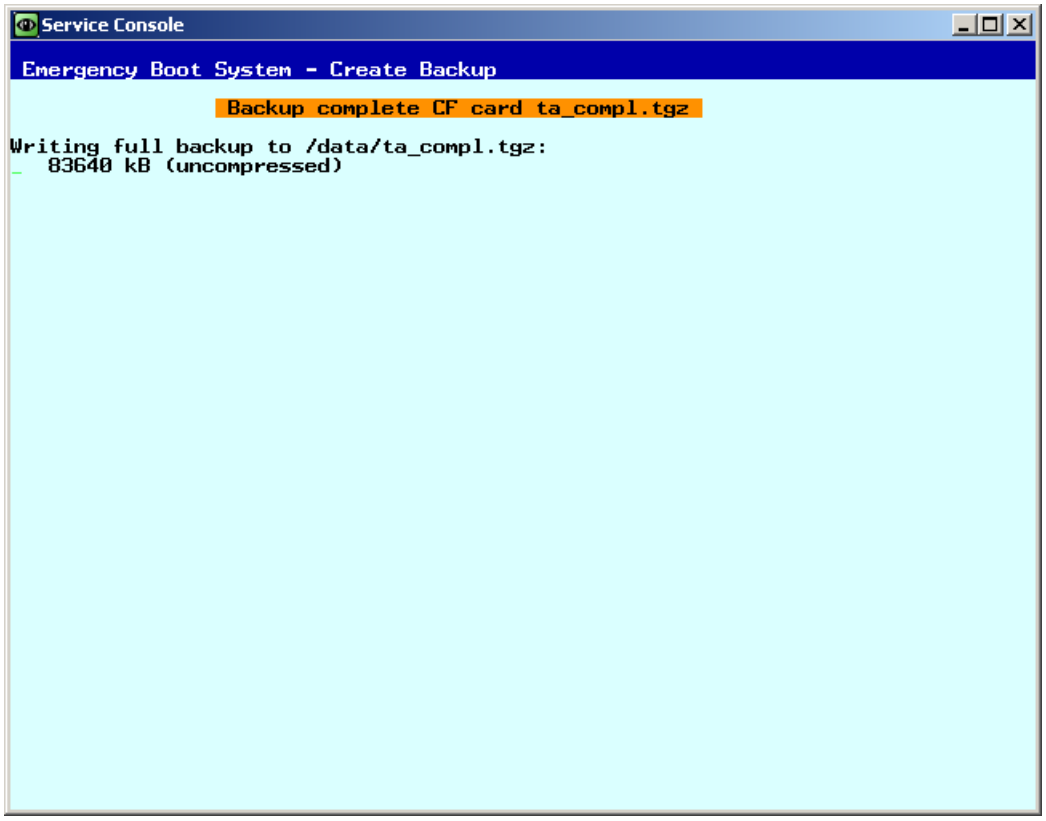

Figure 3-9 Backing up ...

A message is output after the operation has been successfully completed.

See also

The procedure for "Backup complete CF card to network drive" is essentially the same. In addition, you connect to a network drive:

This is how you connect to a network drive (Page 62)

3.3.4 This is how you install a complete system backup

Installing the complete backup

With this menu item, a complete backup of the data from the service system or from a network drive is installed on the CompactFlash Card, i.e. this backup includes both the system software as well as also the user data.

NOTICE
Formatting This procedure corresponds to formatting the CompactFlash Card and all of the existing data are overwritten.

Installing the complete backup

Procedure:

1. In the main menu, select the menu item "Restore NCU Software and Data".

   The following menu is displayed:

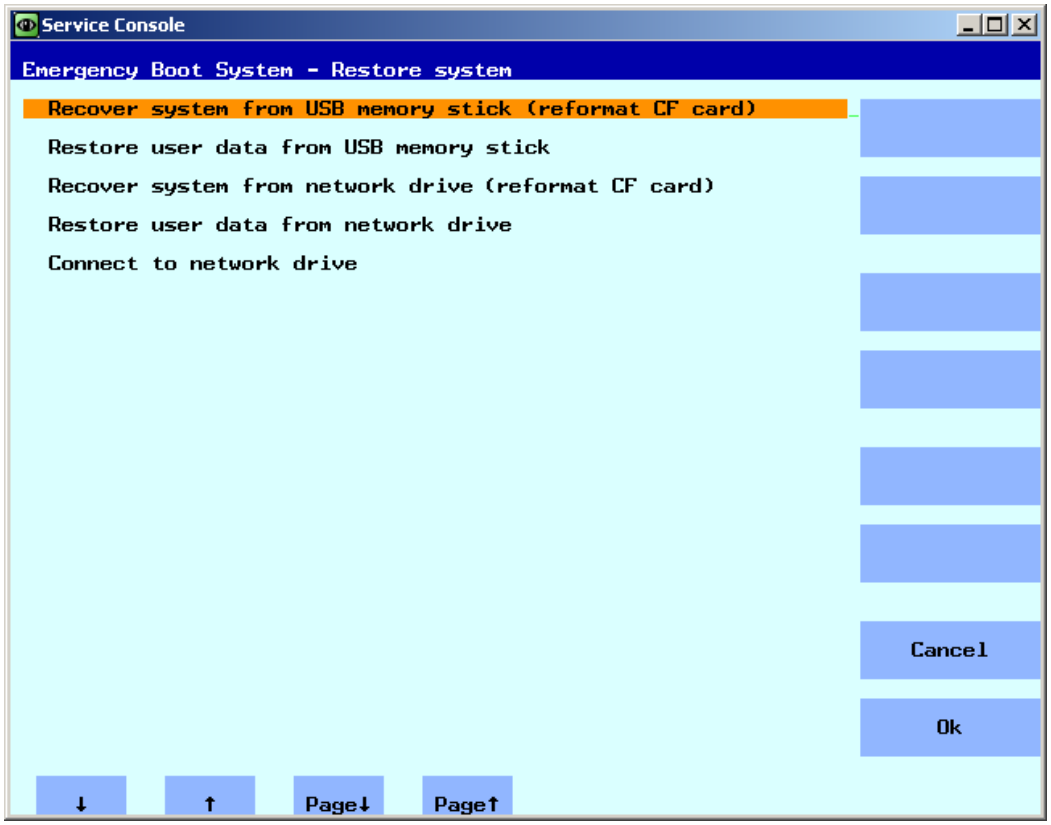

Figure 3-10 Restore system

2. Select the menu item "Recover system from USB memory stick (reformat CF card)" and confirm with "Ok".

   The list of the tgz files available on the USB storage medium are displayed.

3. Select the appropriate tgz file and confirm with "Ok".

   A message is output after the operation has been successfully completed.

Completion

The system must be restarted in order that the new data become effective.

See also

The procedure for "Recover system from network drive (reformat CF card)" is essentially the same. In addition, you connect to a network drive:

This is how you connect to a network drive (Page 62)

3.4 Backing up data via the service shell

Backing up and restoring using a service shell

To call a service shell, depending on the configuration, the following possibilities are available:

(I) Configuration of NCU with TCU: the service shell is called under Linux.

(II) Configuring the NCU with PCU 50 or programming device (PG).

A service shell can be called under:

- on the NCU under Linux
- on the PCU/PG using the VNC Viewer (system network or company network)
- on the PCU/PG using WinSCP (system network or company network)

3.4.1 This is how you save data on a service system

Proceed as follows

To back up the complete system:

1. Connect the service system to a USB interface (X125 or X135) of the NCU and press the reset button.

   Alternatively, you can switch the NCU off, connect the service system, and switch the NCU on again.

   Result: The NCU boots from the service system.

2. In the main menu, select the menu item "Service Shell".
3. Log on as a service technician using the user name "manufact" and password "SUNRISE".
4. Using the command "sc backup" you can create the backup file "backup01.tgz".

   The directory /data on the service system is provided for backup files. The complete path should be specified.

5. Choose –full, to backup all data on the CompactFlash Card, or –user, if you only want to backup user data.

   Example: `sc backup -full /data/backup01.tgz`

   Result:

   A backup file of the complete CompactFlash Card is created under /data on the service system on the USB storage medium.

3.4.2 This is how you restore data from the service system

Proceed as follows

To restore the complete system:

1. Connect the service system to a USB interface (X125 or X135) of the NCU and press the reset button.

   Alternatively, you can switch the NCU off, connect the service system, and switch the NCU on again.

   Result: The NCU boots from the service system and the main menu is displayed.
2. In the main menu, select the menu item "Service Shell".
3. Log on as a service technician using the user name "manufact" and password "SUNRISE".
4. With the command "sc restore" you can write the backup file "backup01" from the service system back to the CompactFlash Card in the NCU. The complete path should be specified.

   Example: `sc restore /data/backup01.tgz`

   Result:

   The system state stored in the file "backup01" is restored on the NCU.

Note

If access to the system data on the CompactFlash Card is not possible because the CompactFlash Card is defective or empty, you can only log in as user "admin" with the password "SUNRISE" and no longer as the user "manufact".

3.4.3 This is how you save data on a network drive

Sequence

Proceed as follows:

- Connect the service system.
- "Service Shell" open.
- Establish a connection to a network drive.
- Create a backup file.

Scenario I: Start Command Shell under Linux

Procedure:

1. Connect the service system to the USB interface X125 or X135 of the NCU.
2. In the main menu, select the menu item "Service Shell".
3. Log on as a service technician using the user name "manufact" and password "SUNRISE".
4. Use the command "sc connect" to connect the network drive:

   ```
   sc connect //username%password@server/share /tmp/backup
   ```

   Please enter here the user name and the password for the network drive that is to be connected to.
5. Using the command "sc save", create the backup file "backup01".

   Choose –full, to backup all data on the CompactFlash Card, or –user, if you only want to backup user data in the directory /user.

   Example: `sc save –full /tmp/backup/backup01`

   Result:

   A backup file of the complete CompactFlash Card is created under the specified path on the network drive.

Scenario II: Start the command shell with WinSCP on the programming device:

Procedure:

1. Start WinSCP and enter the following data in the log-on window:
   - IP address of the NCU (or, if required, host name)
   - User name "manufact" with password "SUNRISE".
2. Select in the menu "Commands" → "Open Terminal".
3. Execute the data backup using the commands described in steps 4 to 6 from scenario I.

Scenario II: Start the command shell using the VNC Viewer on the programming device

Procedure:

1. Start the VNC Viewer and connect to the NCU using the IP address (or where relevant, using the host name)
2. Log on under the "manufact" user name with the password "SUNRISE".
3. To restore the data, enter the corresponding commands as described under steps 3 to 5 in scenario I.

3.4.4 This is how you restore data from the network drive

Sequence

Proceed as follows:

- Connect the service system.
- "Service Shell" open.
- Establish a connection to a network drive.
- Restore the data.

Scenario I: Start command shell under Linux

1. Connect the service system to the USB interface X125 or X135 of the NCU.
2. In the main menu, select the menu item "Service Shell".
3. Log on as a service technician using the user name "manufact" and password "SUNRISE".
4. Use the command "sc connect" to connect the network drive:

   ```
   sc connect //username%password@server/share /tmp/backup
   ```

5. Please enter here the user name and the password for the network drive that is to be connected to.

   To completely restore the system (system data and user data), enter the following: `sc restore –full backup01`

   Result: The whole system is overwritten by the backup data.

6. To restore user data only, enter the following command:

   ```
   sc restore –user backup01
   ```

   Result: The user data are written back again.

   All subsystems are then restarted: `sc start all`

   Result:

   The system state stored in the file "backup01.tgz" is restored on the NCU.

Scenario II: Start the command shell with WinSCP on the programming device:

Procedure:

1. Start WinSCP and enter the following data in the log-on window:
   - IP address of the NCU (or, if required, host name)
   - User name "manufact" with password "SUNRISE".
2. Select in the menu "Commands" → "Open Terminal".
3. To restore the data, enter the corresponding commands as described under steps 3 to 5 in scenario I.

Scenario II: Start the command shell using the VNC Viewer on the programming device

Procedure:

1. Start the VNC Viewer and connect to the NCU using the IP address (or where relevant, using the host name)
2. Log on under the "manufact" user name with the password "SUNRISE".
3. To restore the data, enter the corresponding commands as described under steps 3 to 5 in scenario I.

3.5 Updating the software

3.5.1 This is how you update the firmware

Firmware Update

When service is required, it may be necessary for a service technician to install a BIOS update. Siemens provides the corresponding update file. Possible formats include: *.img or *.rom or *.bin. Or, the update file is already supplied on the service system, then step 1 is eliminated.

Procedure:

1. Copy the update file to the FAT partition of the service system.
2. Connect the service system to interface X125 or X135 of the NCU.
3. Switch on the system.
4. In the main menu, select the menu item "Firmware Update".

   The following menu is displayed:

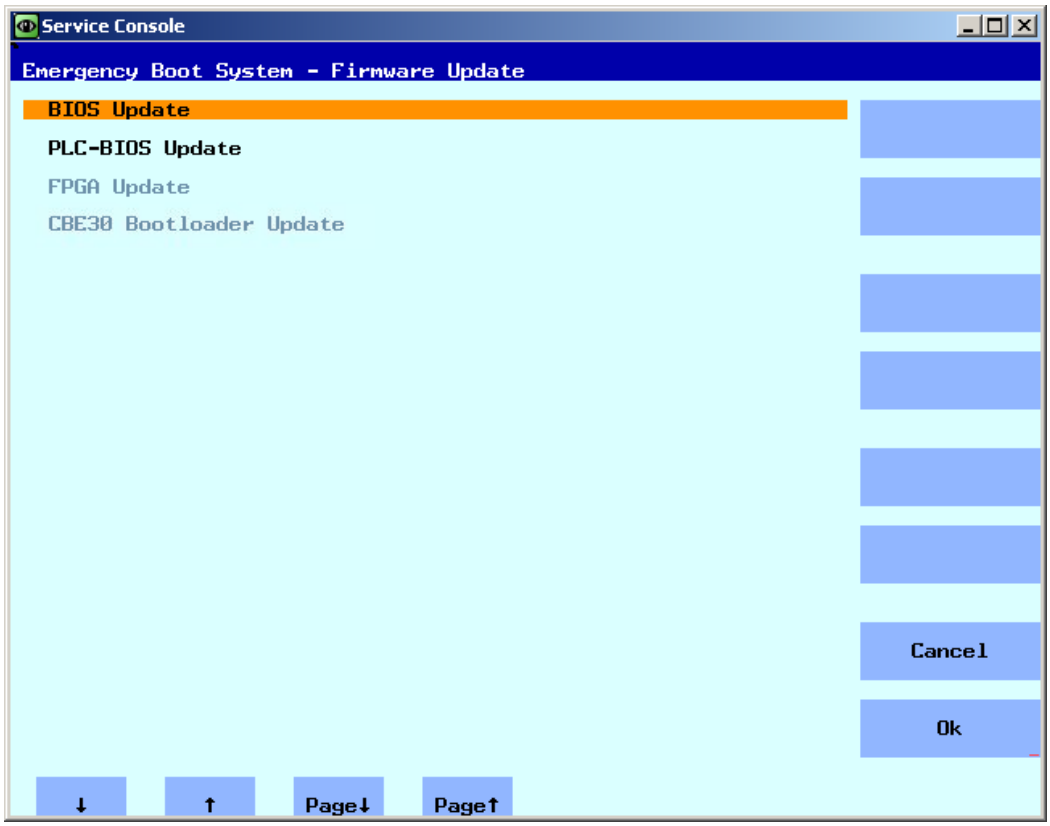

Figure 3-11 Firmware update

5. Select "BIOS Update" and follow the next instructions.

   The BIOS version installed on the NCU and the update files available in the service system are output:

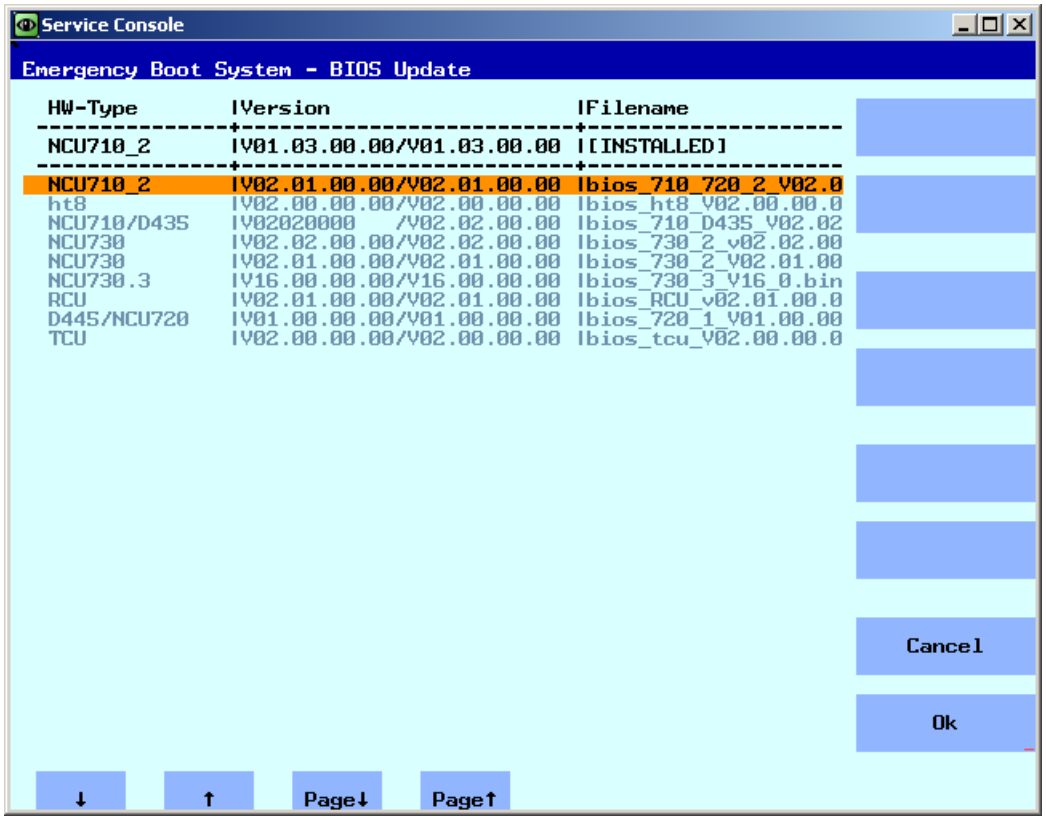

Figure 3-12 Select the updates

6. Select the update file and confirm with "OK".

   A "Restart" is then required.

Note

Fall back strategy

Before the BIOS update is installed, a backup of the installed BIOS version is saved on the service system.

For safety reasons, only files can be selected that are suitable and are appropriate for this NCU.

Update other components

The following rules must be observed for the additional updates:

- The procedure to update the PLC-BIOS Update is essentially the same as the procedure for BIOS Update.
- FPGA Update: for NCU7x0.3
- CBE30 Bootloader Update: for CBE30 and CBE30-2 (option module)

3.5.2 This is how you update the software

Update / Recover

The following options are available:

- Update the software from the service system or from the network drive.
- Completely restore the CompactFlash Card with the system software from the service system or from the network drive (Recover system ...).

Updating the software

Procedure:

1. In the main menu, select the menu item "Update NCU Software and Data".

   The following menu is displayed:

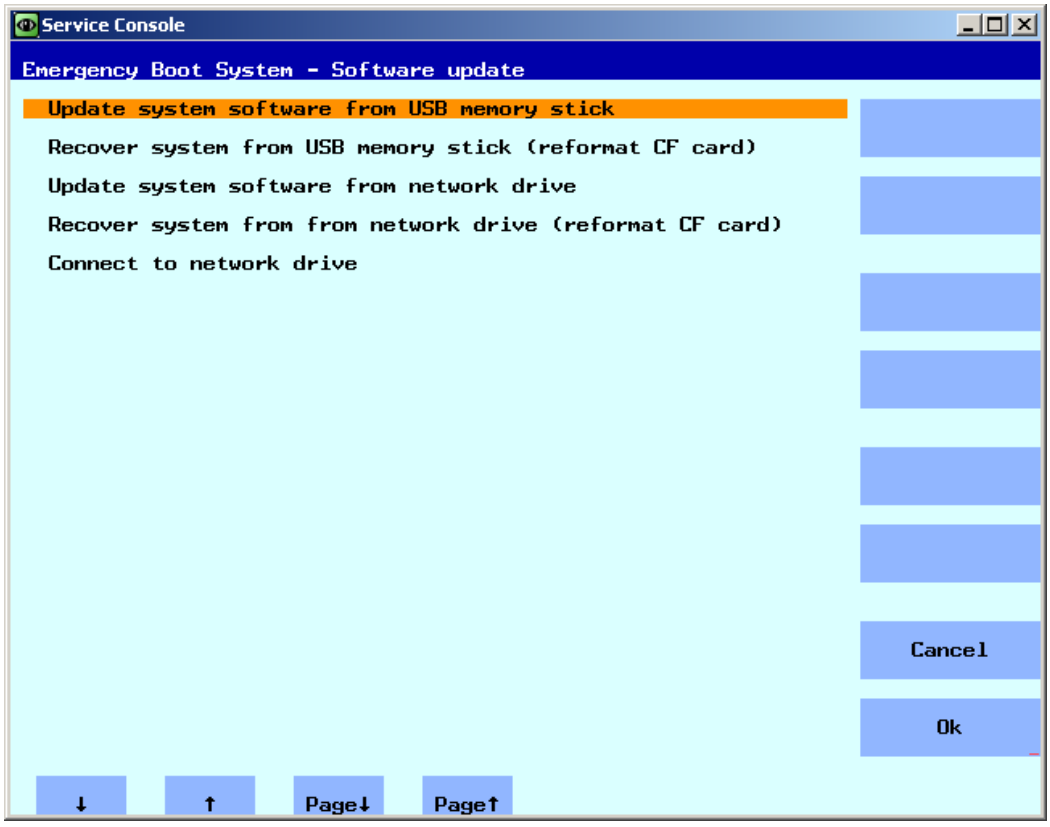

Figure 3-13 Software update

2. Select the menu item "Update system software from USB memory stick".

   The list of the tgz files available on the USB storage medium are displayed.

3. In order to check which software version contains the tgz file, first select the tgz file, then press "Show version".

   The following information is output:

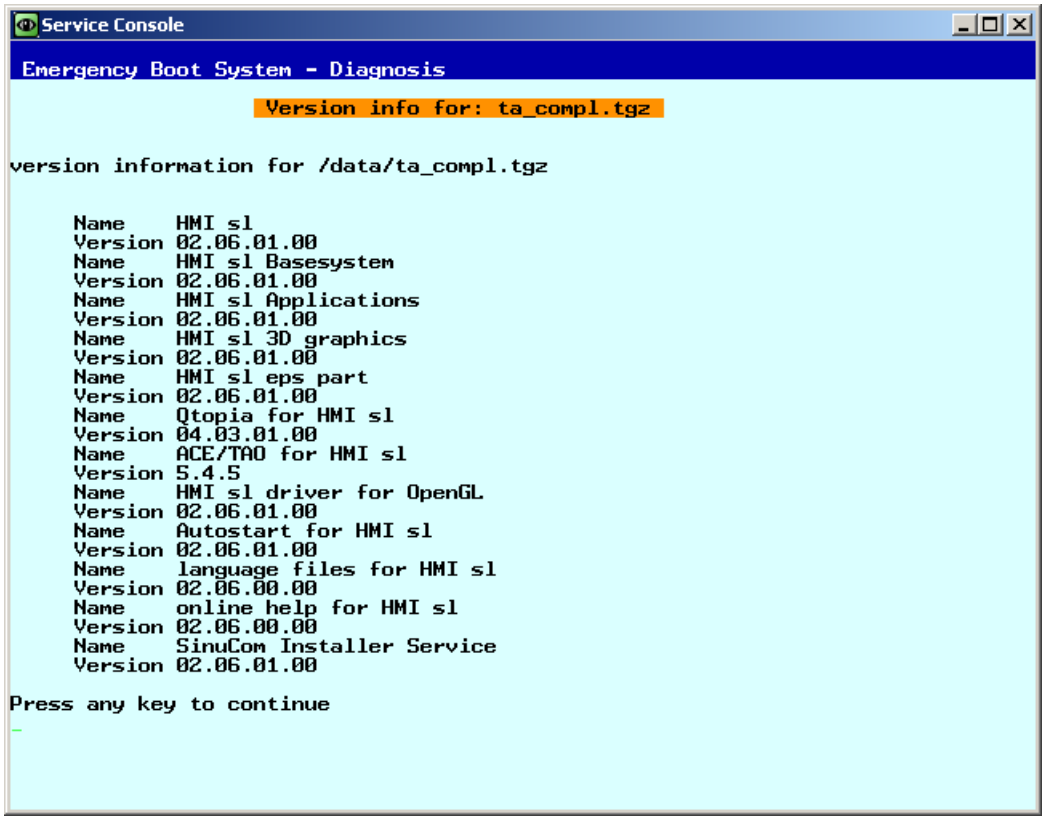

Figure 3-14 Version information

4. Select the appropriate tgz file and confirm with "Ok".

   A message is output after the update has been successfully completed.

Completion

The system must be restarted in order that the new data become effective.

See also

The procedure for "Update system software from network drive" is essentially the same. In addition, you connect to a network drive: This is how you connect to a network drive (Page 62)

For a complete backup of the system: This is how you install a complete system backup (Page 71)

3.6 System diagnostics

3.6.1 Performing system diagnostics

Overview of diagnostic functions

The following diagnostic functions to display network settings are included in this menu:

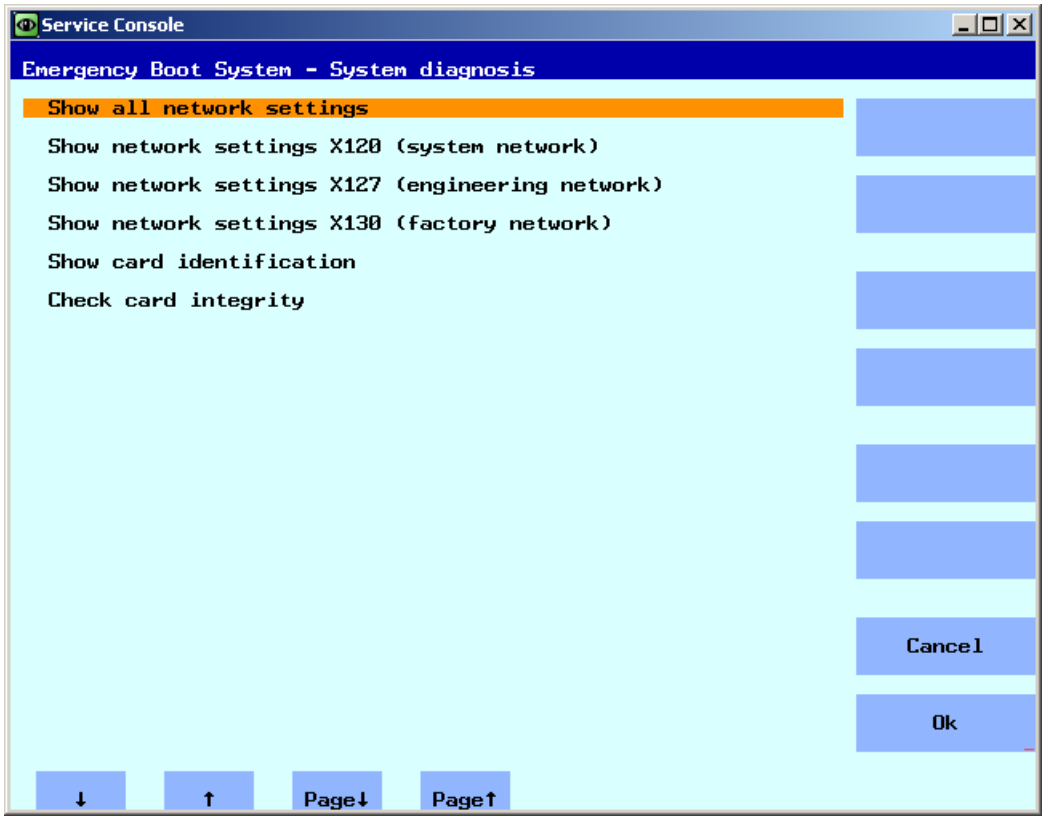

Figure 3-15 Diagnostics functions

System diagnosis	Description
Show all network settings	Connection data of all Ethernet interfaces is displayed.
Show network settings X120 (system network)	The connection data of interface X120 is displayed.
Show network settings X127 (engineering network)	The connection data of interface X127 is displayed.
Show network settings X130 (factory network)	The connection data of interface X130 is displayed.

System diagnosis	Description
Show card identification	The following data of the system CompactFlash Card is output: • Serial number • System software version • Hardware version (NCU)
Check card integrity	Checking the CompactFlash Card system

Example: Connection data of all Ethernet interfaces of the NCU:

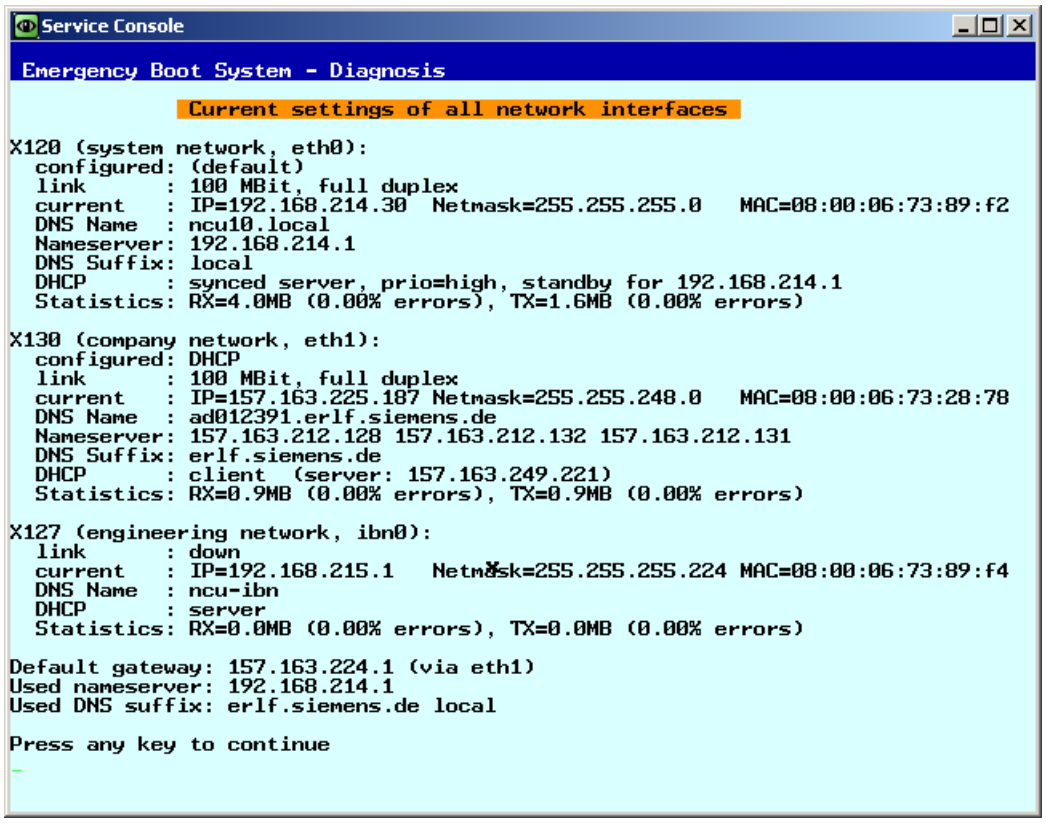

Figure 3-16 NCU: Interfaces

See also

This is how you check the CompactFlash Card (Page 85)

3.6.2 This is how you change the system settings

Modify NCU Settings

You can change the following system settings in this menu:

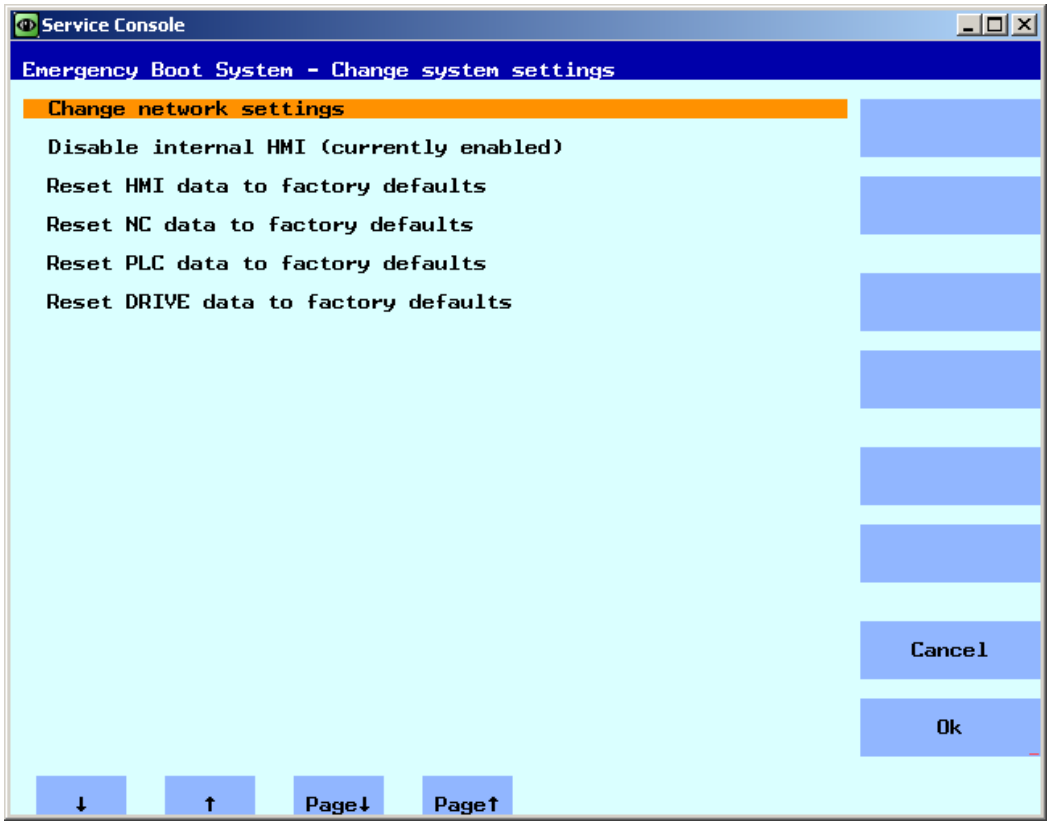

Figure 3-17 Changing system settings

Menu item	Description
Change network settings	Changing network settings of the NCU.
Disable internal HMI (currently enabled)	Activating/deactivating an HMI task
Reset HMI data to factory defaults	Restoring the delivery condition of HMI data.
Reset NC data to factory defaults	Restoring the delivery condition of NC data.
Reset PLC data to factory defaults	Restoring the delivery condition of PLC data.
Reset DRIVE data to factory defaults	Restoring the delivery condition of drive data.

NOTICE
Reset ... data to factory defaults The selected data are reset to the state when delivered, therefore overwriting all of the previous specific commissioning settings that have been made.

3.6.3 This is how you check the CompactFlash Card

Displaying identification data

Procedure:

1. In the main menu, select the menu item "Diagnosis".

   The following menu is displayed:

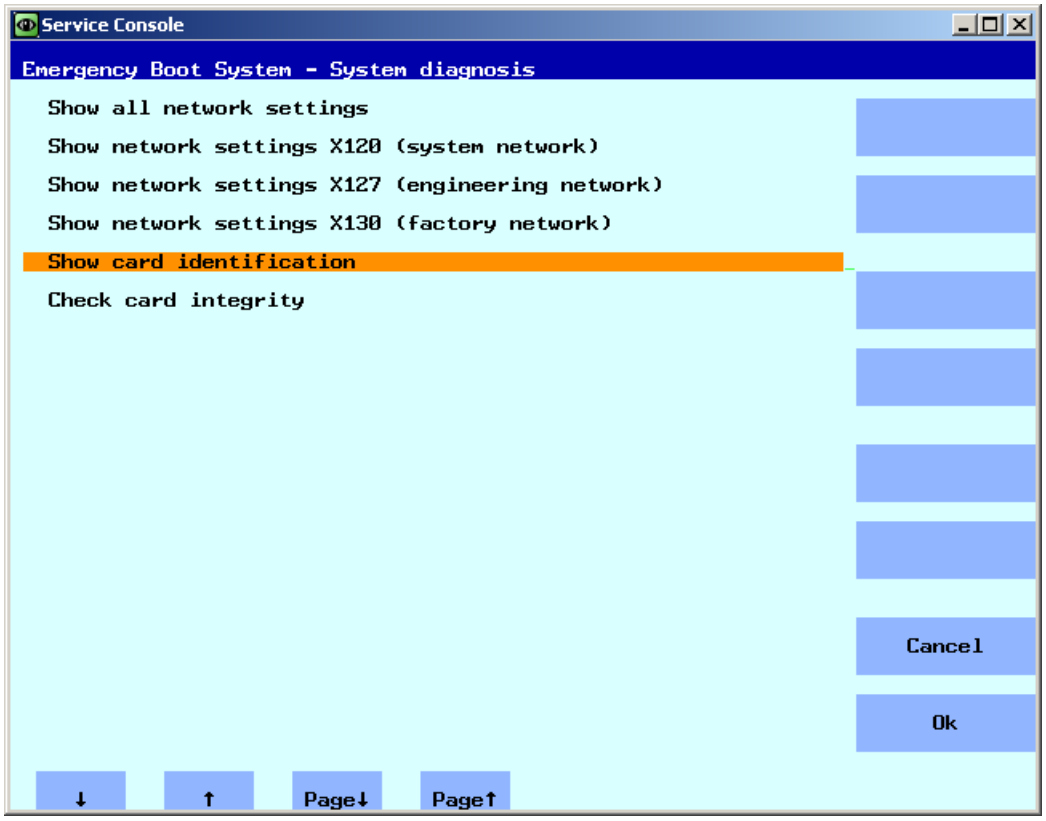

Figure 3-18 System diagnostics

2. Select the menu item "Show card identification".

   The following data for identification are output:

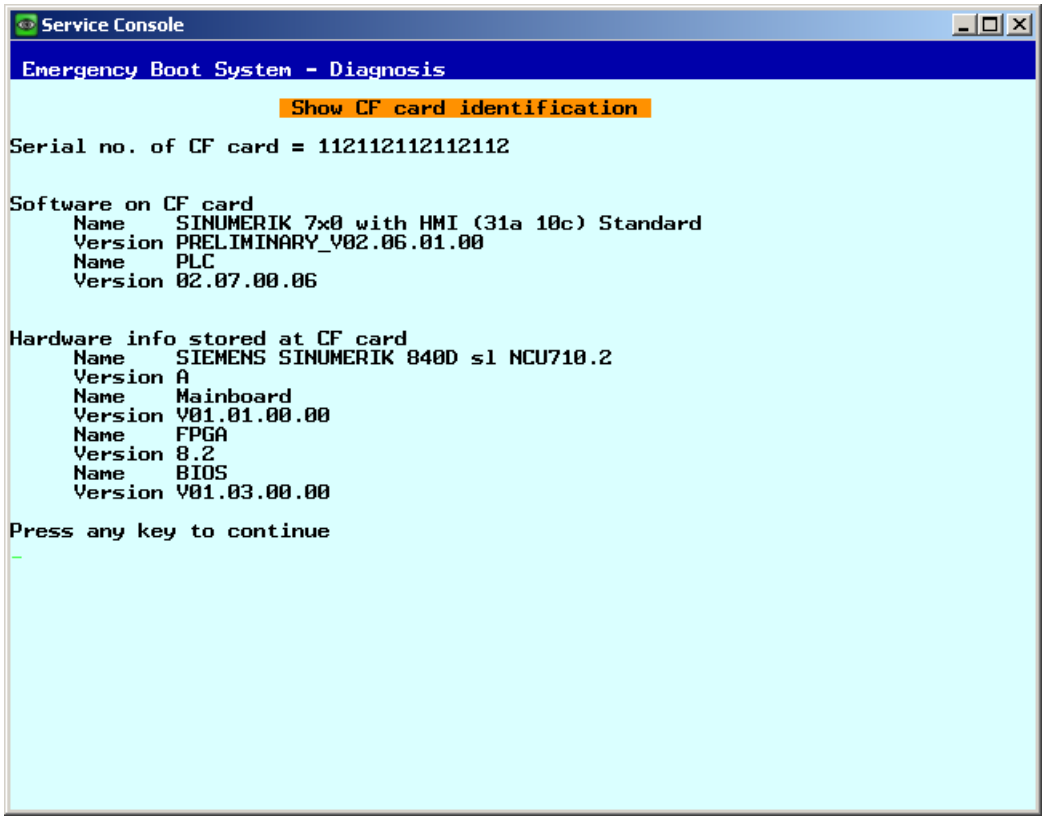

Figure 3-19 Identification

3. Select the menu item "Check card integritiy".

   The CompactFlash Card is checked for errors:

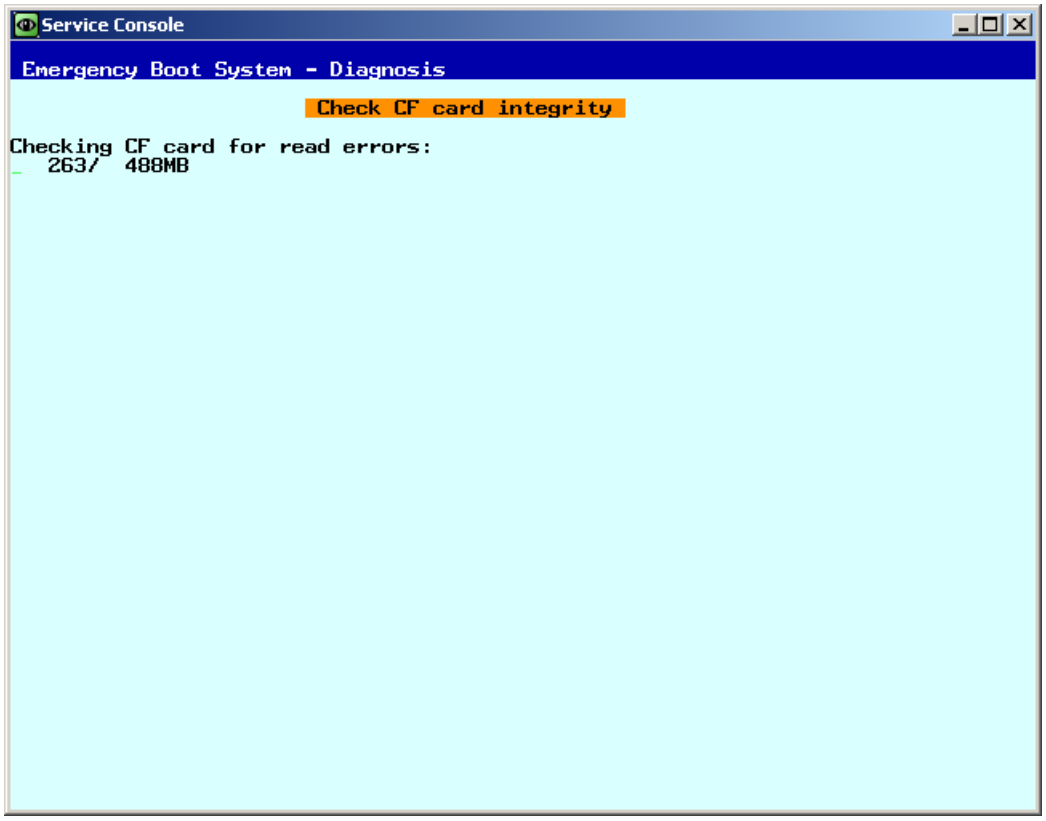

Figure 3-20 Check

Note

This procedure can take several minutes.

3.6.4 Calling the VNC Viewer

Purpose

The VNC Viewer is used to connect directly with a VNC Server and, for example, to operate an HMI application.

Furthermore, it enables you to call up a list of all the network devices, thereby obtaining an overview of the system network.

Starting the VNC Viewer

Procedure:

1. In the main menu, select the menu item "VNC Viewer".

   The following menu is displayed:

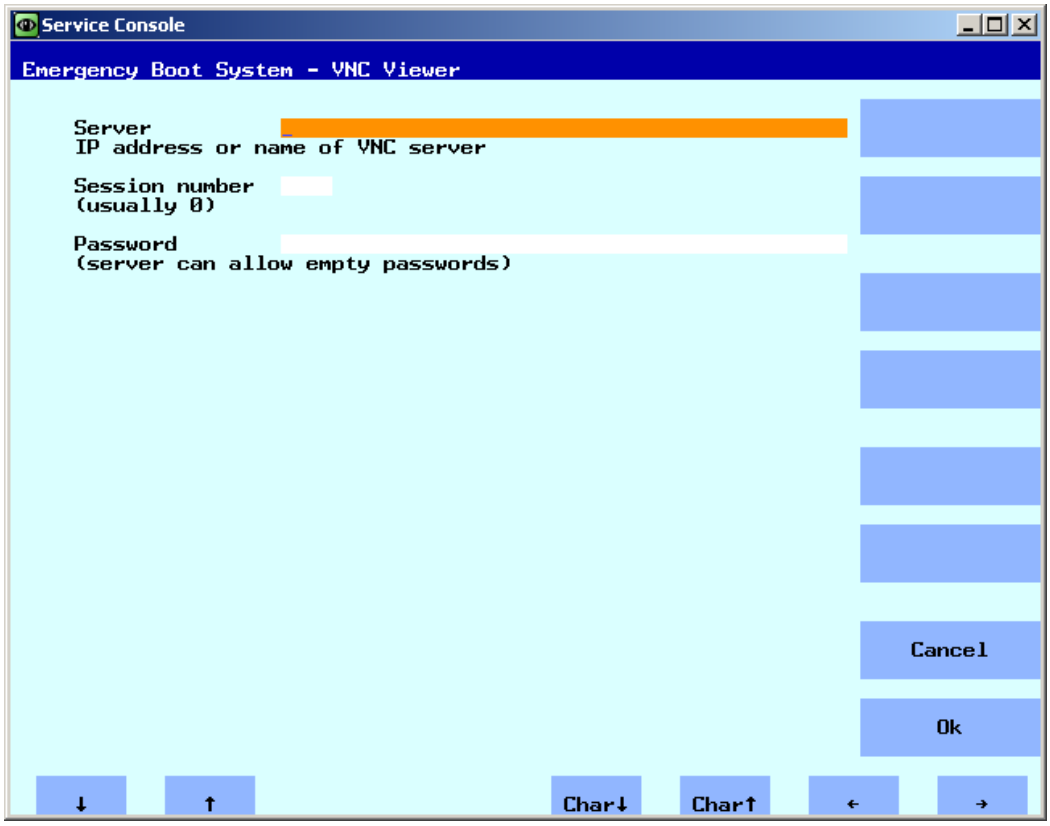

Figure 3-21 VNC Viewer

2. To start the VNC Viewer, enter the following connection data:
   - Server name, e.g. IP address or DNS.
   - The password is optional and can also be left empty.
   - The following assignment applies to the "Session number":

Number	Meaning
Session 0	HMI-Applikation
Session 4	Command Shell
Session 5	System logfile
Session 6	System Network Center (SNC)

3.6.5 WinSCP and PuTTY

Use

The programs WinSCP and PuTTY are freely-available open source programs for Windows. WinSCP is intended especially for transferring files from and to Linux systems, PuTTY for the remote operation of a command shell.

- WinSCP can be downloaded via the following link: http://winscp.net/eng/download.php (http://winscp.net/eng/download.php) (Installation Package).

  WinSCP also offers a "command shell" that is limited so that commands can be issued, but no callbacks can be answered.

- PuTTY, by contrast, offers a complete command shell.

  PuTTY web page: http://www.chiark.greenend.org.uk/~sgtatham/putty (http://www.chiark.greenend.org.uk/~sgtatham/putty)

With both programs, a service technician can log onto the NCU and carry out service tasks. The username ‘manufact’ with the password ‘SUNRISE’ is available for the Siemens service technician.

Starting WinSCP

WinSCP is started from Windows after the service technician has logged onto the NCU with which he is connected using the corresponding authorization (e.g. as user "manufact" with password "SUNRISE").

From the "Commands“ menu, select ”Open terminal” to open a command shell. There you can carry out the service commands in the usual way.

Appendix

A

A.1 Abbreviations

CF	CompactFlash card: Memory card
CFS	Cluster File System
DCK	Direct Control Keys: Direct control keys
DCP	Discovery and Basic Configuration Protocol
DHCP	Dynamic Host Configuration Protocol: Dynamic assignment of an IP address and other configuration parameters on a computer in a network
DNS	Domain Name System: Conversion of domain names into IP addresses
EBS	Emergency Boot System
EKS	Electronic Key System: System to check the identity of a user (authentication system)
EUNA	End User Notification Administration
HMI	Human Machine Interface: Operator interface
IRT	Isochronous Realtime (Ethernet)
LLDP	Link Layer Discovery Protocol: multi-vendor Layer 2 Protocol defined in accordance with the IEEE-802.1AB standard, allows information to be exchanged between devices.
MAC	Media Access Control: The MAC address is a 48-bit Ethernet ID.
MCP	Machine Control Panel: Machine control panel
MPI	Multi-Point Interface: Multiple interface
MUI	Multilanguage User Interface
NCK	Numerical Control Kernel: NC kernel with block preparation, travel range, etc.
NCU	Numerical Control Unit: NCK hardware unit
NRT	Non-Realtime (Ethernet)
NTFS	New Technology File System
NTP	Network Time Protocol: Standard for synchronizing clocks in the entire network
NTPD	NTP Daemon: Utility that runs in the background and does not have to be started by the user.
PCU	PC Unit: Computer unit
PDEV	Physical device
PG	Programming device
PLC	Programmable Logic Control: Programmable logic controller
RAM	Random Access Memory: Program memory which can be read and written into
RDY	Ready: The system is ready to operate.
SNMP	Simple Network Management Protocol (network protocol for monitoring and controlling network elements such as routers, servers, switches, and printers from a central station).
SSD	Solid State Drive
TCU	Thin Client Unit
TFTP	Trivial File Transfer Protocol: Very simple data transmission protocol
UDP	User Datagram Protocol: NTP is mostly processed via UDP.

USB	Universal Serial Bus
UPS	Uninterruptible power supply
UTC	Universal Time, Coordinated: Coordinated universal time
VNC	Virtual Network Computing

Glossary

CFS (Compressed File System)

A CFS (file extension ".cfs") is a compressed file system, similar to a zip file. It contains files and subdirectories that look like normal files on the controller at runtime. Files and directories contained in a CFS cannot be changed. They are decompressed at runtime as required.

Network interface

The network interface is an interface that enables network communication. These are the Ethernet interfaces on the NCU.

NFS (Network File System)

NFS is the most common protocol for remote file systems in the world of Unix, and is also available for Windows. NFS is closely based on the Unix privilege model – each time a file is accessed, a UID and GID are supplied which the server then uses to decide whether the operation is permitted. The server relies on the client to provide the correct IDs.

Remote File System

A file system that is contacted over the network. The files are physically located on another computer in the network (the "server"), but appear locally the same as all other files. Operations performed on these files are sent via the network to the server, instead of being executed directly on a local storage medium (such as a hard drive or CompactFlash Card).

As a server usually exports more than one file system, a name for the required file system must also be entered in addition to the name of the server.

SMB (Server Message Block)

SMB is the underlying protocol of MS Windows file systems (also known as drives, releases, shares, etc.). SMB connections are always active in the context of a specific user, who must be known to the server. Exported file systems have a name (release name), by which they can be addressed. The client does not need to know the concrete path on the server.

Subsystem

A subsystem is a CFS that not only contains a collection of files, but also executes a program, for example, at runtime. To do this, the CFS contains a script that is used to control the starting and stopping of this program.

For this reason, only administrators are permitted to set up NFS file systems, and NFS is usually only implemented in uniformly administrated environments. Exported file systems on the server are addressed directly on the server via their path.

VNC (Virtual Network Computing)

Virtual Network Computing is a software that displays the screen contents of a remote computer, with a running VNC server, on a local computer, with a running VNC viewer, and in return sends keyboard and mouse movements of the local computer to the remote computer.

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SIEMENS

SINUMERIK

SINUMERIK 840D sl PCU-Basesoftware (IM8)

Commissioning Manual

Valid for:

SINUMERIK PCU 50.3 with PCU-Basesoftware V8.6 SP3

SINUMERIK PCU 50.5 with PCU-Basesoftware V5XP1.3

02/2012

6FC5397-1DP40-3BA0

Legal information

Warning notice system

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 relevant 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 product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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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.

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Order number: 6FC5397-1DP40-3BA0
℗ 11/2011 Technical data subject to change

Table of contents

Commissioning the system

1

1.1 Delivery condition of the system

Overview

The PCU has onboard interfaces for communicating via Ethernet, MPI and PROFIBUS DP. The integrated free slots remain free for other tasks. The PCU is equipped with the Windows XP ProEmbSys operating system and for data backup tasks with the Symantec Ghost software.

Interfaces:

- Four USB ports (USB 2.0) offer points where a keyboard, mouse and other peripheral devices can be connected.
- For CF cards, there is a covered slot.
- Two internal PCI slots are available for specific expansions.

For commissioning:

- Two 7-segment displays and two LEDs are integrated for diagnostic purposes. They indicate the current operating status and display the BIOS error codes during boot up.
- If the PCU is to be operated without an operator panel front, a monitor and an additional keyboard will also be required:
  - For diagnostics when booting the PCU
  - When installing a replacement hard disk

    (alternatively, the hard disk can also be installed externally).

References: Operator Components and Networking Manual

Supplied software on the PCU

The software installed on delivery of the PCU includes the components below, among others:

MS Windows XP Professional SP3	
Internet Explorer	V 6.0
MPI driver (PCU 50.3 and PCU 50.5-C)	V 6.04.01.00
Symantec Ghost (default setting)	V 8.2 (incl. Ghost Explorer)
TCU Support (is already installed and available on the hard disk under D:\Updates, if it must be re-installed.)	V 8.6

Documentation for all Ghost tools is supplied on the PCU's hard disk under E:\TOOLS.

Note

For the system component versions contained in the PCU Basesoftware, see the C:\BaseVers.txt file.

1.1.1 Hard disk partitions

Memory segmentation

The hard disk of the **PCU 50.3** has 40 GB of storage capacity and is segmented into a primary partition C and an expanded partition with the three logical drives D, E and F which operate with NTFS file access.

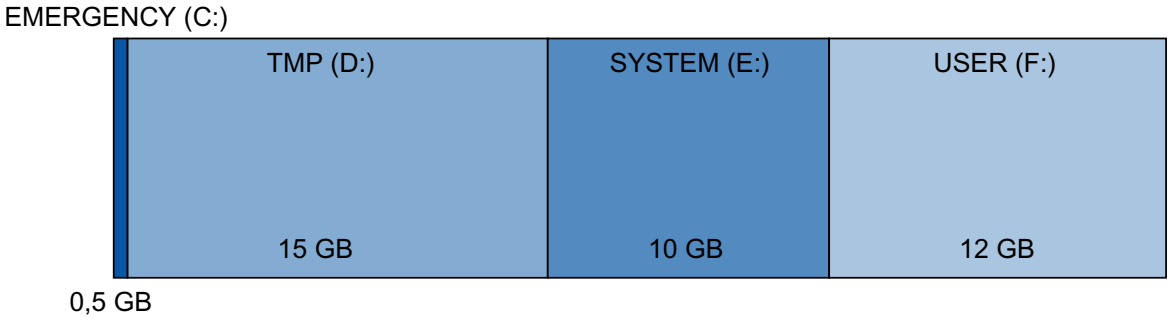


Figure 1-1 Division of the hard disk

The **PCU 50.5** is equipped with a solid state drive (SSD) with NTFS file access, which is also segmented to provide a primary partition C and an expanded partition with the three logical drives D, E and F. The SSD is available with 32 GB and 40 GB storage capacity.

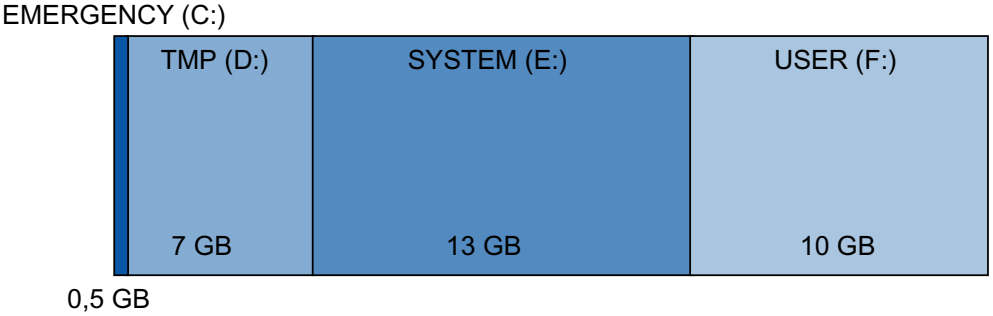


Figure 1-2 Segmentation of the SSD with 32 GB

Partitioning of the SSD with 40 GB is identical to that for partitioning of the hard disk.

Depending on the order, the operating software can already be installed when the unit is shipped. It is installed subsequently by the customer the first time the system is booted up. For reasons of data security, the operating software and the Windows XP system software are distributed over the different hard disk partitions.

Content of the partitions

The individual partitions are intended for the following data or already contain this data:

EMERGENCY (C:)	Reserved for service tasks under WinPE 2005.
TMP (D:)	Used for storing Ghost images (e.g. of the status on delivery) and local backup images. Contains the installation directory where the software to be installed is first copied to from a remote PG/PC prior to the actual installation procedure.
SYSTEM (E:)	Reserved for the Windows XP software. The Windows XP software is available on the recovery media CD via network, for example to install drivers or updates as and when needed later on.
USER (F:)	For installing user programs. Applications such as HMI system software (incl. data storage and temporary data), STEP 7, OEM applications for HMI or customer-specific applications should only be installed here.

NOTICE

All of the applications must be exclusively installed on USER (F:) even if these applications have a different drive set as the default drive in their installation path.

The partition names EMERGENCY, TMP, SYSTEM, USER must not be changed; otherwise the "ServiceCenter" will no longer function.

See also

Installing SINUMERIK products (Page 63)

Starting ServiceCenter Backup Restore (Page 73)

1.1.2 System features

Configuration of the operating system

For safety reasons, Windows XP has been preset as follows:

- The Autorun function is deactivated.
- Automatic Windows Update is deactivated.
- Monitoring and alerts for antivirus software and automatic update are deactivated.
- Links used to call up Internet Explorer from the service desktop and the start menu are removed.
- Remote Procedure Call (RPC) is possible for calls that are not connected.
- The firewall settings are activated on the network card Eth 1 and deactivated on Eth 2.

Changes to Windows services

Other default settings:

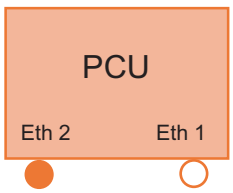
Windows services:	Start-up type:	
Computer Browser	Manual	(Not started)
Error Reporting Service	Disabled	
Portable Media Serial Number	Manual	(Not started)
SSDP Discovery Service	Disabled	
Universal Plug and Play Host	Disabled	
Web Client	Manual	(Not started)
Wireless Zero Configuration	Manual	(Not started)

Name of the PCU

Upon delivery of the system, a unique computer name is generated which can be read out under: "Start" → "Settings" → "Control Panel" → "System", "Computer Name" tab.

Pre-configuration of the PCU

The PCU has two Ethernet interfaces with default settings suitable to connect to SINUMERIK solution line:



Eth 1 is preset as a default DHCP client for connection to a company network.

Eth 2 is preset as a SINUMERIK DHCP server for connection to a system network. Eth 2 is preset to the fixed IP address 192.168.214.241.

See also

This is how you set the IP address of the PCU (Page 42)

References: Operator Components and Networking Manual

1.2 User administration

1.2.1 Which users are set up?

Preset users

Each user is from one user type and belongs to one user group. The user types are implemented under Windows in user groups with various user rights.

Upon delivery of the system, the following users are defined at the factory:

- **The "operator"**

  In terms of type, the "operator" is classed as an HMI user and belongs to the operators' user group (operator.group). These operators have limited user rights under Windows.

- **The "user"**

  In terms of type, the "user" is classed as an HMI user and belongs to the operators' user group (user.group). These operators have extended user rights under Windows.

- **The "auduser".**

  The "auduser" is an HMI service user type of user and belongs to the system administrators' user group. The system administrators have the user rights of a local administrator under Windows.

User name	Password	User type	Windows user group	User Rights	User group
operator	operator	HMI (operator.group)	operator.group	Restricted	Operator
user	CUSTOMER	HMI (user.group)	user.group	"Power User"	Operator
auduser	SUNRISE	HMI+Service	Administrators	local administrator	System administrators
siemens	*****	---	---	---	System administrators

The individual user types differ in the following areas:

User type	Area of activity
HMI (operator.group)	• Boot up of the PCU • Operating the HMI program • Windows Desktop
HMI (user.group)	• Boot up of the PCU • Operating the HMI program • Windows desktop
HMI+Service	• Boot up of the PCU • Operating the HMI program • Service Desktop

Service Desktop

The service desktop provides the HMI+Service user with a Windows desktop, which is expanded to include tools and functions for service tasks, such as manage users, install software, save/restore data, check system integrity, etc.

Windows desktop

The HMI user is able to use a Windows desktop which can be expanded to suit his or her individual needs.

Starting ServiceCenter Users

Using this link on the service desktop, you can start ServiceCenter Users **as an HMI+Service user**. In ServiceCenter Users, the boot behavior of the PCU as well as settings for the HMI program and desktop are set globally for all users and individually for specific users.

The users are managed in the "ServiceCenter Users", so that the commissioner/service technician no longer has to make corresponding settings directly in the registry.

1.2.2 User settings

"Global Settings"

In the ServiceCenter Users, as **HMI service user**, you set parameters under "Global Settings" for the system behavior:

- When the PCU is booting up
- When the HMI program is starting
- With reference to the desktop

Note

The following diagrams show, as an example, an application with the SINUMERIK Operate software installed.

Using ServiceCenter Users

Buttons:

- Use "Exit" to quit ServiceCenter Users.
- If you press the "Reboot" button, the system immediately reboots (without prior prompting).

"Startup (1)" tab

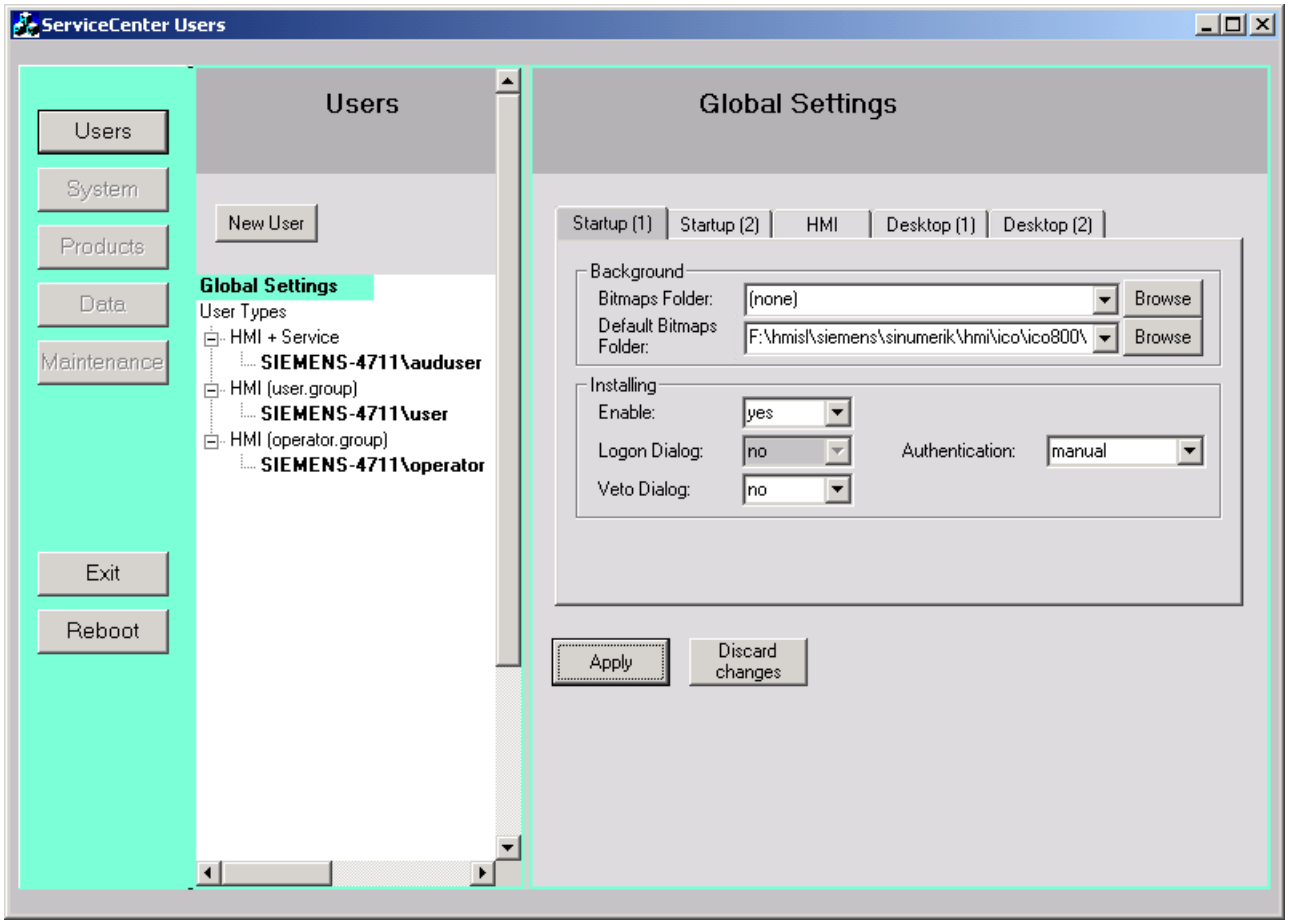


Figure 1-3 Global Settings: Startup (1) tab

Table 1- 1 The default is marked in "**bold**".

Startup (1) tab	**Option**	**Effect**
Background		
Bitmaps folder:	F:\hmisl\siemens\sinumerik\hmi\ico\ ...	Directory with boot screens
Default bitmap folder:	**F:\hmisl\siemens\sinumerik\hmi\ico\ico800**	Directory containing default boot screens
Installing		
Enable:	**"yes"**	Authorization is in place to install user software during booting.
	"no"	No installation authorization
Logon dialog:	"yes"	Display "Installing Logon" dialog.
	"no"	Do not display "Installing Logon" dialog.
Veto Dialog:	**"no"**	For pending installation during the boot up: No prompting, the installation begins immediately.

Startup (1) tab	Option	Effect
	"yes"	For pending installation during the boot up: Prompt asking whether to install.
Authentication:	**"manual"**	Authentication of an HMI+Service user in the "Installing Logon" dialog is undertaken manually.
	"EKS"	Authentication of an HMI+Service user in the "Installing Logon" dialog involves EKS. The "Installing Logon" dialog appears if authentication by EKS has failed in the background.
	"manual+EKS"	Authentication of an HMI+Service user in the "Installing Logon" dialog either involves EKS or is performed manually.

"Startup (2)" tab

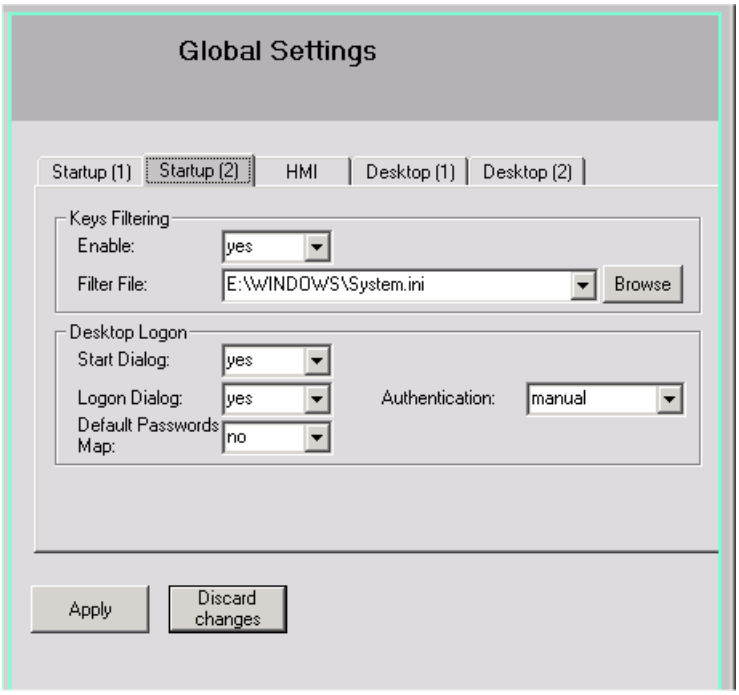


Figure 1-4 "Startup (2)" tab

Table 1- 2 The default is marked in "**bold**".

Startup (2) tab	Option	Effect
Keys, filtering		
Enable	**"yes"**	Key filtering is activated.
	"no"	Key filtering not activated.
Filter file	**E:\WINDOWS\System.ini**	Select the file with filter settings
Desktop Logon		

Startup (2) tab	Option	Effect
Start dialog:	**"yes"**	Display "Desktop Access" dialog
	"no"	Do not display "Desktop Access" dialog
Logon Dialog:	**"yes"**	Display "Desktop Logon" dialog.
	"no"	Do not display "Desktop Logon" dialog.
Default password map:	**"no"**	The password must be entered exactly as specified.
	"yes"	The password is not case-sensitive.
Authentication:	**"manual"**	Authentication with user name and password (manual)
	"EKS"	Authentication with EKS
	"manual+EKS"	Either authentication with user name and password or with EKS

"HMI" tab

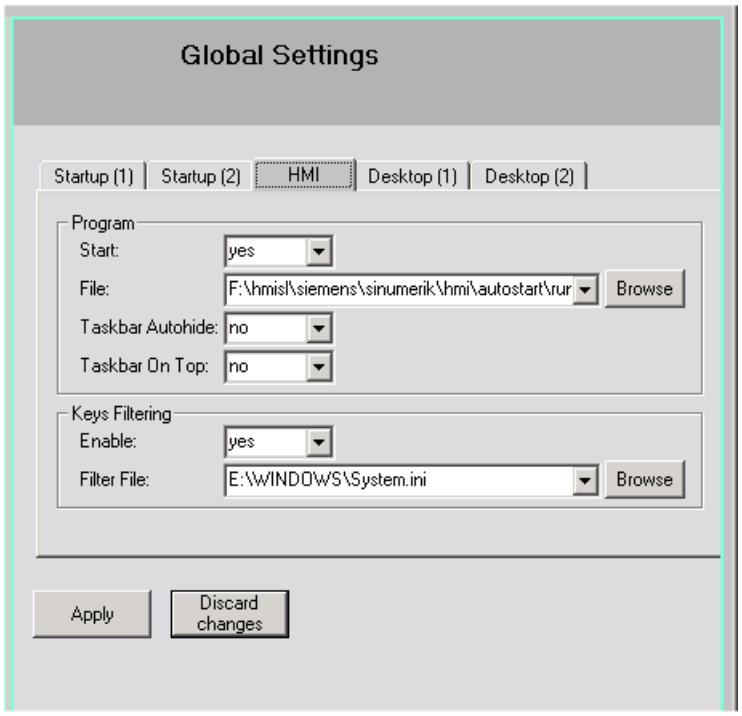


Figure 1-5 "HMI" tab

Table 1- 3 The default is marked in "**bold**".

"HMI" tab	Option	Effect
Keys Filtering		
Enable	**"yes"**	Key filtering is activated.
	"no"	Key filtering not activated.
Filter file	**E:\WINDOWS\System.ini**	Select the file with filter settings

"HMI" tab	Option	Effect
Program		
Start:	**"yes"**	The HMI program is started.
	"no"	The HMI program is not started.
File:	**F:\hmisl\siemens\sinumerik\hmi\autostart\run_hmi.exe**	Select the HMI program
Task bar autohide:	**"no"**	HMI program: Hide start task bar
	"yes"	HMI program: Show start task bar
Task bar on top:	**"no"**	HMI program: Start task bar in the background
	"yes"	HMI program: Start task bar always visible

"Desktop (1)" tab

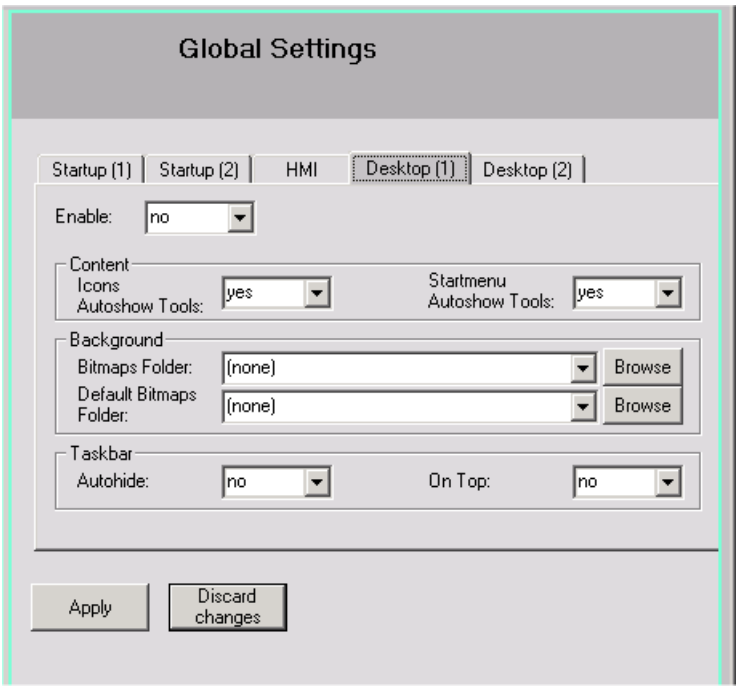


Figure 1-6 "Desktop (1)" tab

Table 1- 4 The default is marked in "**bold**".

"Desktop (1)" tab	Option	Effect
Enable:	"no"	Desktop not displayed **(Default: for HMI user)**
	"yes"	Displaying the desktop **(Default: only for HMI+Service user)**
Content		
Icons Autoshow Tools:	"no"	Do not display links on the desktop.
	"yes"	Display links on the desktop.

"Desktop (1)" tab	Option	Effect
Startmenu Autoshow Tools:	"no"	Do not display programs in the "Start menu"
	"yes"	Display programs in the "Start menu".
Background		
Bitmaps folder:	**(none)**	Directory with background screens for the desktop
Default bitmap folder:	**(none)**	Directory with default background screens for the desktop
Task bar		
Autohide:	**"no"**	Desktop: Hide start task bar
	"yes"	Desktop: Show start task bar
On Top:	**"no"**	Desktop: Start task bar in the background
	"yes"	Desktop: Start task bar always visible

"Desktop (2)" tab

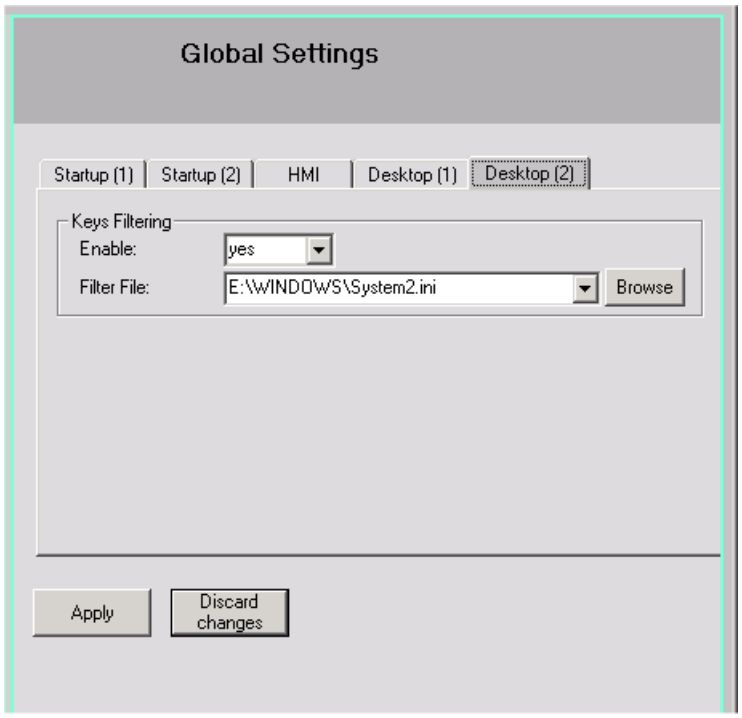


Figure 1-7 SCU "Desktop (2)" tab

Table 1- 5 The default is marked in "**bold**".

"Desktop (2)" tab	Option	Effect
Keys, filtering		
Enable	**"yes"**	Key filtering is activated.
	"no"	Key filtering not activated.
Filter file	**E:\WINDOWS\System2.ini**	Select the file with filter settings

Principle of passing on

The settings made under "Global Settings" are passed on to individual users. The settings which are passed on can still be adapted to suit each user.

Example: Specific user settings

The settings under "Global Settings" are inherited by all users:

1. Left-click the user in the "Users" list.
2. After entering the password, you can adapt the settings as required.

   The settings that cannot be changed are displayed with a gray background.

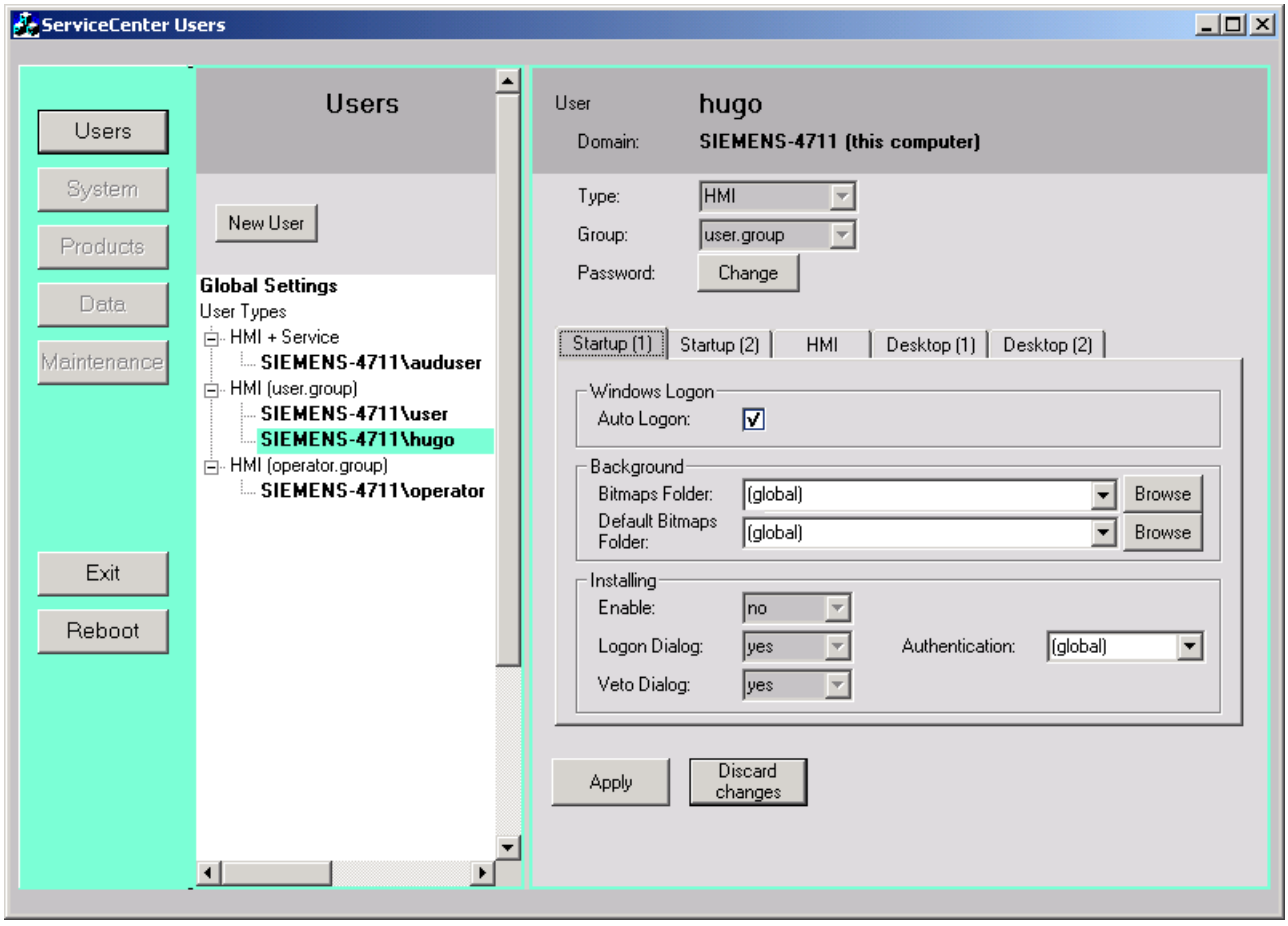


Figure 1-8 Specific settings for the "HMI (user.group)" user

1.2.3 This is how you create a new user

Creating new users

Procedure:

1. Click on "New User" button.
2. Enter a user name.
3. Assign a user type, e.g. "HMI", and a user group to the user.

   The Windows user group is only active locally on the PCU.

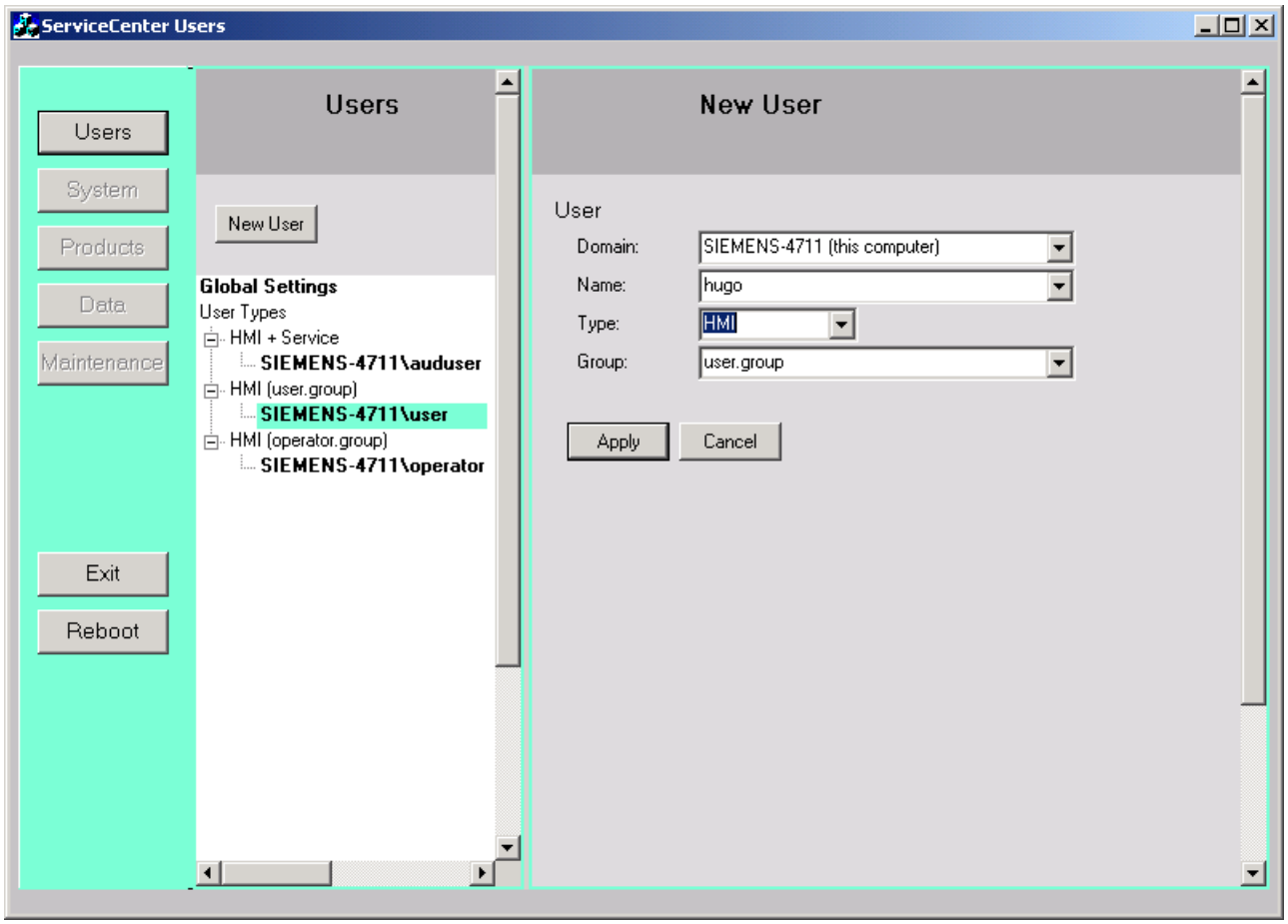


Figure 1-9 ServiceCenter Users: New user

4. Confirm with "Apply".
5. You will then be asked to specify a password.
6. After confirming with "OK", the new user is created and displayed in the list under "Users".

Adding new users from a domain

If the PCU is a member of a domain, users already existing in this domain can be added as HMI users or HMI+Service users:

1. Click on the "New User" button.
2. To do this, select the corresponding entry in the "Domain" list and a user from the "Name" list.
3. Assign a user type and a user group to the user.

   The Windows user group is only active locally on the PCU.

See also

How to add the PCU to a domain (Page 43)

1.2.4 This is how you administer users

Overview

As an HMI+Service user, you can execute the following tasks in the Users ServiceCenter:

- Change user names.
- Delete users.

Change the user name

1. Left or right-click the user who you wish to rename in the list.
2. To change the user name, select "Rename" from the pop-up menu.
3. Enter a new name and confirm with OK.

Deleting a user

To delete a user again, follow these steps:

1. Left or right-click the user who you wish to delete in the list.
2. To delete the user, select "Delete" from the short-cut menu using righthand mouse key.

Result: The user is deleted after confirming the confirmation prompt.

1.3 Boot up behavior of the PCU

1.3.1 Dialogs when booting

Selection when booting up

The following dialogs are shown during boot up:

- **"Installing Logon" dialog.**

  This dialog is displayed if an "Install" directory is found on a bootable storage medium (e.g. USB-FlashDrive) when booting up.

Figure 1-10 Installing Logon

- **"Desktop Access" dialog**
  - This dialog is displayed if **either** no HMI program is installed, the installation has been skipped **or** the start of the HMI program has been deactivated during ramp-up.

    Displaying this dialog can be suppressed through configuration in the global or user settings. "Desktop" is then selected as the default.

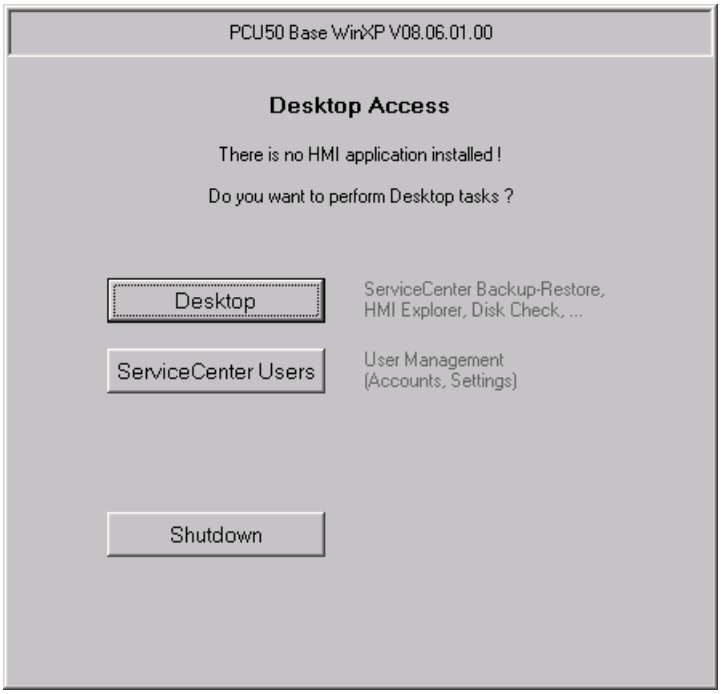


Figure 1-11 Desktop Access (example without HMI program)

Note

If an HMI program is installed, the "Start HMI" button is also available in the "Desktop Access" dialog.

- **"Desktop Logon" dialog**

  The "Desktop Logon" dialog enables the user to log on to the desktop. This dialog also appears

  – If no valid user data has been provided by the authentication system (EKS).

  – If authentication on the "Startup(1)" tab is set to "manual".

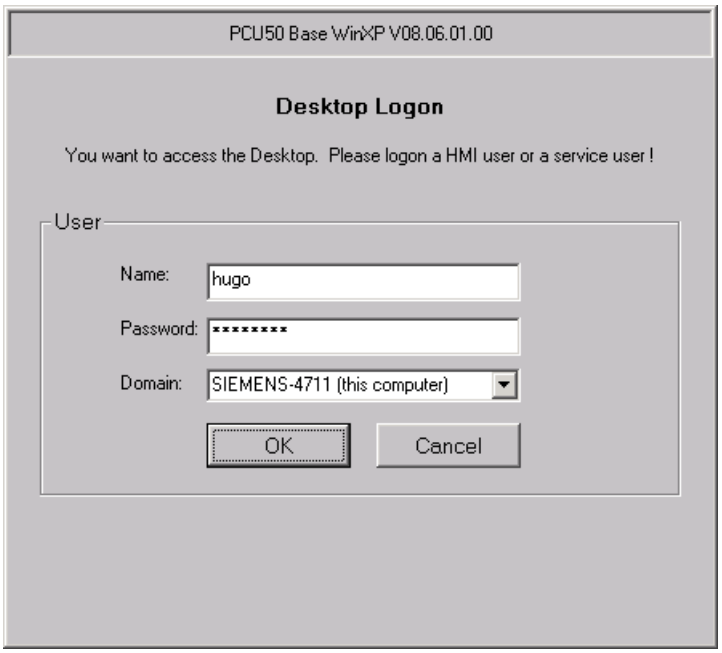


Figure 1-12 Desktop Logon (with authentication: "manual")

NOTICE

Setting the access level via EKS:

- If an EKS unit is active, i.e., the key is inserted and can be evaluated, then the key information for the EKS unit alone determines the active access level. The access level in the HMI program cannot be changed when EKS is active.
- If the key is withdrawn from the active EKS unit, i.e. the EKS unit becomes inactive, the system adopts the current access level as determined by the key switch.
- If changing the operating right amongst the operating stations, the EKS unit of the new active operating station is authoritative. If no EKS unit is assigned there, the effect is the same as for an inactive EKS unit.
- The key information is evaluated by the HMI. Once an access level has been determined from the key information, HMI adopts this access level and also sets it in the NCK: The last access level set always applies to the system.

1.3.2 Boot up of the PCU: no HMI program installed

Requirement

No HMI program is installed during the PCU boot up.

Ramp-up phase

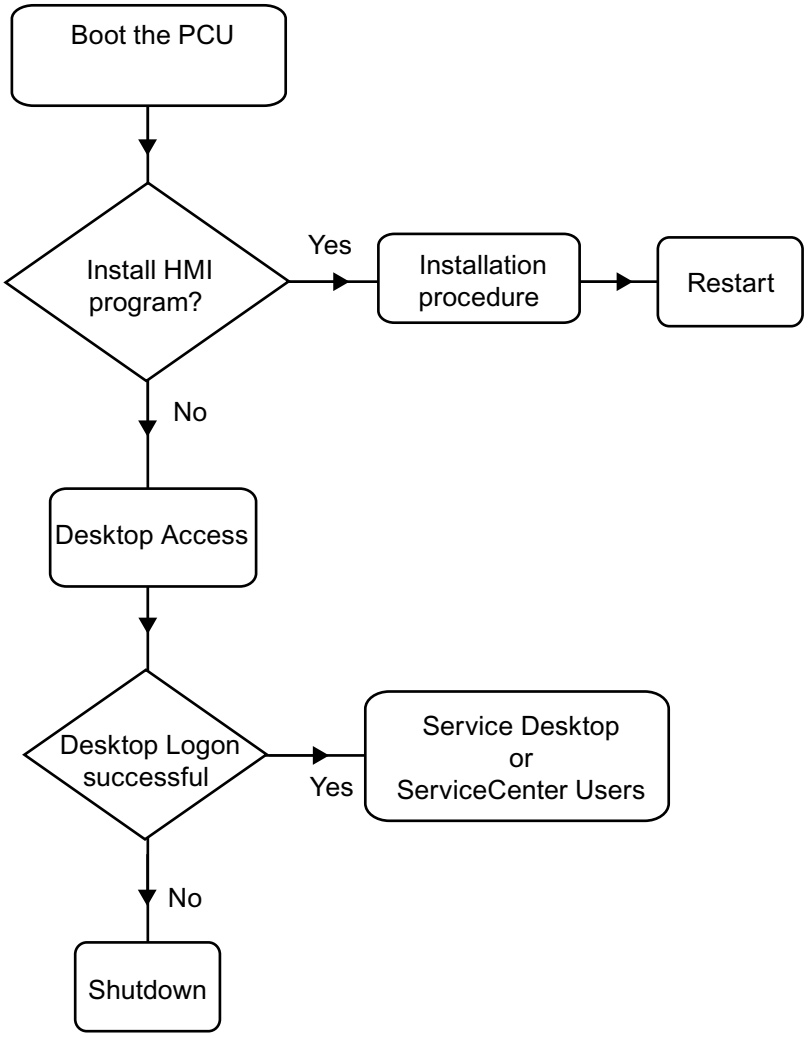


Figure 1-13 PCU bootup diagram (without HMI program)

Explanations:

- If installation programs are present in directory D:\Install, you will be prompted during the first boot up as to whether the installation procedure should be started. After installation is completed, you need to restart the system.

  The installation can also be skipped and carried out later. To do this, use the HMI Explorer (Installation via service desktop (Page 64)).

- "Desktop", "ServiceCenter Users" or "Shutdown" can be selected in the dialog "Desktop Access".
  - When selecting "Desktop", the "Desktop Logon" dialog is opened.
  - When selecting "ServiceCenter Users", the "Installing Logon" dialog is opened.

  Note

  When booting the PCU for the **first** time, the user can only log on as 'auduser'.

1.3.3 Boot up of the PCU: HMI program already installed

Requirement

There is already an HMI program installed.

Ramp-up phase

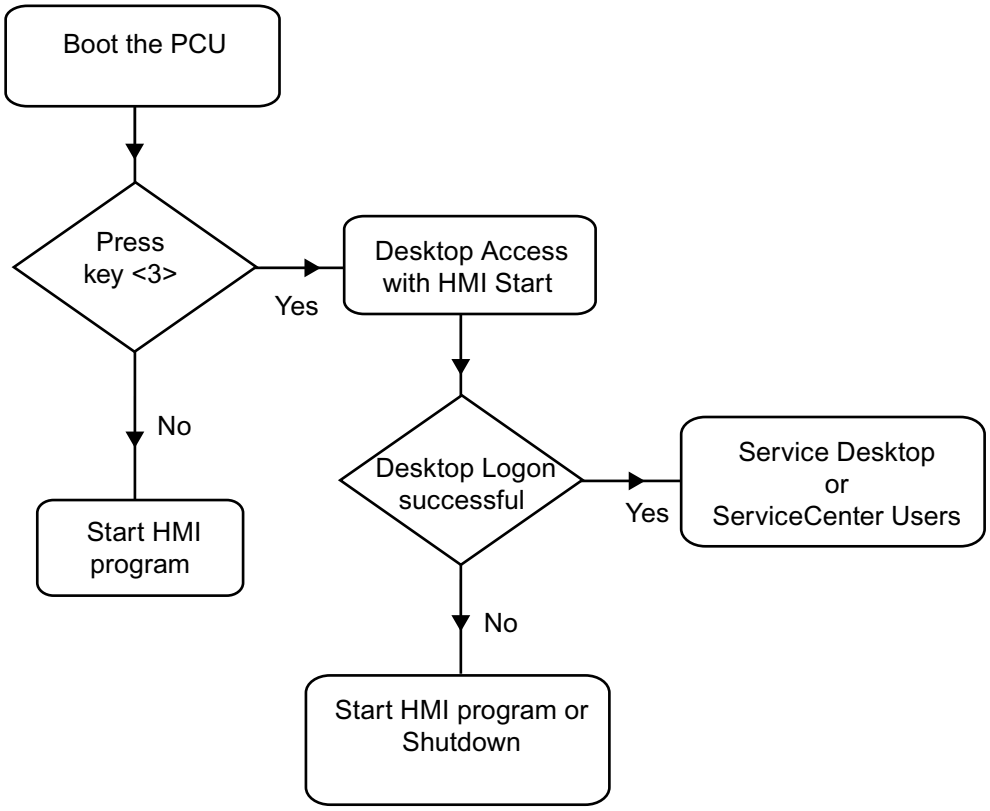


Figure 1-14 PCU bootup diagram (HMI program installed)

Explanations:

- If the HMI program is already installed, the PCU boots up and the HMI program is started (default).
- During the boot up, there is a time interval for pressing key <3> when the version information appears on the lower right of the background screen. Then the "Installing Logon" dialog opens.
- To carry out service tasks, you will have to log on as a service user.

  The following input options are available:

  – Manual logon to a domain using user name and password.
  – Logon using EKS: A key and valid user data for authentication must be provided for this. If valid user data is not available via the EKS, the "Desktop Logon" dialog is displayed along with user name and password.
  – Both options can be selected.

1.3.4 Setting the screen resolution

Overview

The system behavior during boot up for the screen resolution is set in the file tcu.ini. You will find the delivery status for tcu.ini in E:\siemens\system\etc.

Modified tcu.ini files are saved in F:\addon_base\..., F:\oem_base\..., F:\user_base\...

Reference: Operator Components Manual, "Networking" chapter

Set the resolution when booting up the PCU

The following options are available in the # RESOLUTION section in the tcu.ini:

0 = SYSTEM

1 = AUTO_OP_1 (default)

2 = AUTO_OP_2

3 = AUTO_MON_1

4 = AUTO_MON_2

5 = 640X480

6 = 800X600

7 = 1024X768

8 = 1280X1024

The meanings of the settings are as follows:

Settings	Meaning
SYSTEM	The resolution is not specially set; i.e., the resolution last used in the system is active, e.g., the resolution which had been set manually in the Control Panel.
AUTO_OP_1	Default: During boot up, the resolution is automatically set ("PCU panel" has priority) in accordance with the following scenarios:
Example 1:	There is a PCU panel (irrespective of whether there is a PCU monitor and TCU panels) [in active TCU mode: The following additional condition applies: PCU is activated (with dynamic resolution switching enabled)]: The resolution is set to the max. resolution of the PCU panel (max. 1280x1024).

Settings	Meaning
Example 2:	There is no PCU panel, however there is a PCU monitor (irrespective of whether there are any TCU panels): [in active TCU mode: The following additional condition applies: PCU is activated (with dynamic resolution switching enabled)]: The resolution is not specially set; i.e., the resolution last used in the system is active, e.g., the resolution which had been set manually in the Control Panel. (Different to AUTO_OP_2 !)
AUTO_OP_2	Like AUTO_OP_1, except: Example 2: There is no PCU panel, however there is a PCU monitor (irrespective of whether there are any TCU panels): [in active TCU mode: The following additional condition applies: PCU is activated (with dynamic resolution switching enabled)]: The resolution is set to the max. resolution of the PCU monitor, reduced to the next lowest SINUMERIK resolution. The SINUMERIK resolutions are 640x480, 800x600, 1024x768 and 1280x1024. **Example:** In the case of a PCU monitor with a max. resolution of 1440x900, the SINUMERIK resolution setting is 1280x1024.
AUTO_MON_1	During boot up, the resolution is automatically set ("PCU monitor" has priority) in accordance with the following scenarios:
Example 1:	There is a PCU monitor (irrespective of whether there is a PCU panel and TCU panels) [in active TCU mode: The following additional condition applies: PCU is activated (with dynamic resolution switching enabled)]: The resolution is set to the max. resolution of the PCU monitor, reduced to the next lowest SINUMERIK resolution. The SINUMERIK resolutions are 640x480, 800x600, 1024x768 and 1280x1024. **Example:** In the case of a PCU monitor with a max. resolution of 1440x900, the SINUMERIK resolution setting is 1280x1024. If there is a PCU panel, the display there is panned if the max. resolution of the PCU panel is lower than the max. resolution of the PCU monitor.
Example 2:	There is no PCU monitor, however there is a PCU panel (irrespective of whether there are any TCU panels): [in active TCU mode: The following additional condition applies: PCU is activated (with dynamic resolution switching enabled)]: The resolution is not specially set; i.e., the resolution last used in the system is active, e.g., the resolution which had been set manually in the Control Panel. (Different to AUTO_MON_2 !)

Settings	Meaning
Example 3:	There is no PCU monitor and no PCU panel (= headless operation): A) in active TCU mode: a) dynamic resolution switching is enabled (resolution adaptation entry in TCU.ini) and at least one TCU is already logged on: The resolution is set to the resolution of the TCU which is currently active. b) dynamic resolution switching is enabled (resolution adaptation entry in TCU.ini) and no TCU has logged on yet or dynamic resolution switching is disabled: The resolution is set to the max. resolution of the current PCU panel, i.e., which logged on during the previous session. Default: Default TCU resolution in accordance with the registry. **Notice:** The first TCU panel to logon (later) becomes activated. The focus handler then automatically sets the resolution to this TCU panel's resolution (in the case of dynamic resolution switching). A) in inactive TCU mode: The resolution is not specially set - i.e. the resolution used during the previous session in the system is active, e.g. the resolution set manually in Control Panel.
AUTO_MON_2	Like AUTO_MON_1, except: Example 2: There is no PCU monitor, however there is a PCU panel (irrespective of whether there are any TCU panels): [in active TCU mode: The following additional condition applies: PCU is activated (with dynamic resolution switching enabled)]: The resolution is set to the max. resolution of the PCU panel (max. 1280x1024).
640X480	During boot up, the SINUMERIK resolution is set to 640x480.
800X600	During boot up, the SINUMERIK resolution is set to 800x600.
1024X768	During boot up, the SINUMERIK resolution is set to 1024x768.
1280X1024	During boot up, the SINUMERIK resolution is set to 1280x1024.

1.4 BIOS settings for PCU 50.3

Overview

The BIOS of the PCU is preset in such a way that no changes are required. The date and time can be set under Windows or the operator interface.

NOTICE
Your device configuration is preset for working with the software supplied with the unit. You should only change the preset values if you have modified your device in any way, or if a fault occurs when the unit is powered up.

Starting BIOS setup

1. Start the BIOS SETUP as follows:

   Reset the device (warm or cold restart).

   After the first boot up, the following message appears:

   ```
   Press < F2 > to enter SETUP or <ESC> to show boot menu
   ```

2. Press the F2 key as long as the BIOS prompt appears on the screen.

   The BIOS main menu opens:

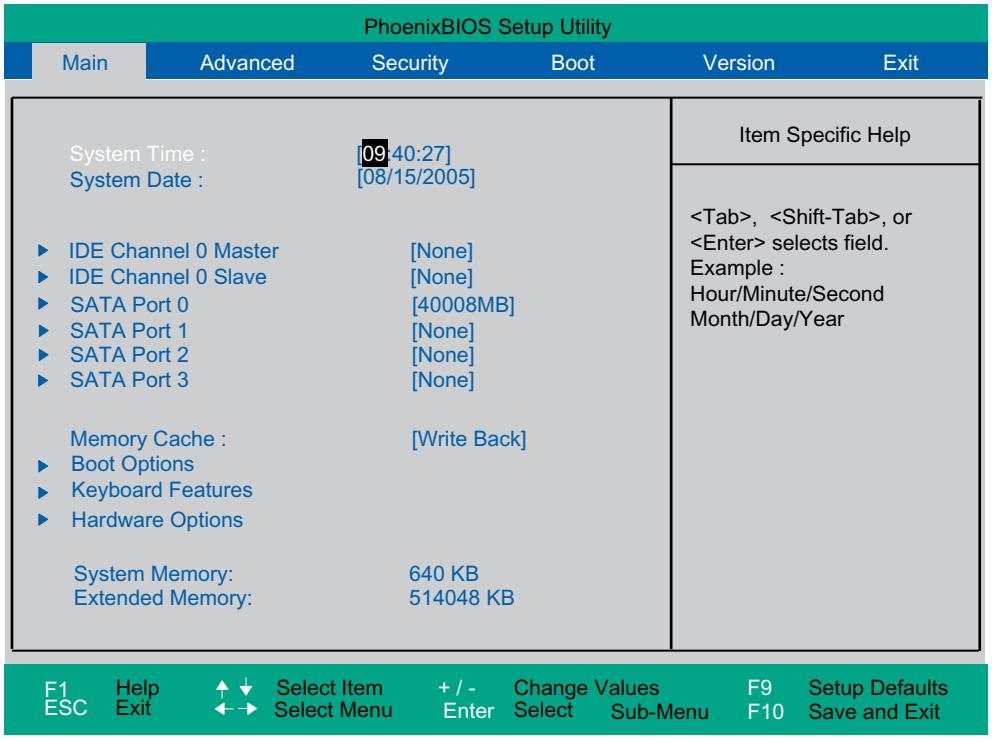


Figure 1-15 BIOS Main Menu (Example)

BIOS setup: Defaults

The following system parameters are saved on delivery:

Menu: Main

System parameters	Defaults	Custom entries
System Time	hh:mm:ss	
System Date	MM/DD/YYYY	
IDE Channel 0 Master	None	
IDE Channel 0 Slave	None	
SATA Port 0	40008 MB	
SATA Port 1	None	
SATA Port 2	None	
SATA Port 3	None	
Memory Cache	Write Back	

Boot options		
Quick boot mode	Enabled	
SETUP prompt	Enabled	
POST errors	All, but not keyboard	
Summary screen	Enabled	
Diagnostic screen	Enabled	
Post Code/Status	LPC Bus	

Keyboard features		
Numlock	ON	
Key click	Disabled	
Keyboard auto-repeat rate	30 / sec	
Keyboard auto-repeat delay	½ sec	

Hardware Options		
PCI MPI/DP	Enabled	
Onboard Ethernet 1	Enabled	
On-board Ethernet 1 Address	08 00 06 90 xx xx	
On-board Ethernet 1 Remote Boot	Enabled	
Onboard Ethernet 2	Enabled	
On-board Ethernet 2 Address	08 00 06 90 xx xx	
On-board Ethernet 2 Remote Boot	Disabled	
SafeCard functions	Enabled	

Hardware Options		
Fan control	Enabled	
CRT/LCD selection	Simultan. Auto	

Menu: Advanced

System parameters	Defaults	Custom entries
Installed O/S	Other	
Reset configuration data	No	
Legacy USB support	Disabled	
USB controller restart	Enabled	
I/O Device Configuration		
Internal COM 1	Enabled	
Base I/O address	3F8	
Interrupt	IRQ 4	

PCI Configuration		
PCI device slot 1		
Option ROM scan	Enabled	
Enable master	Enabled	
Latency timer	Default	
PCI device slot 2		
Option ROM scan	Enabled	
Enable master	Enabled	
Latency timer	Default	

SATA/PATA Configuration		
PATA Controller:	Enabled	
SATA Controller mode	Enhanced	
AHCI Configuration	Disabled	
RAID support	Disabled	

Menu: Security

System parameters	Defaults	Custom entries
Supervisor password is	Disabled	
User password is	Disabled	
Set user password	Enter	
Set supervisor password	Enter	
Password on boot	Disabled	
Fixed disk boot sector	Standard	

Menu: Boot

System parameters	Defaults	Custom entries
Boot priority order:		
1: SATA0:	Fujitsu MHT2040BHTBD	
2: PCI BEV:	VIA BootAgent	
3:		
4:		
5:		
6:		
7:		
8:		
Excluded from boot order:		

Menu: Version

System parameters	Defaults	
SIMATIC PC	SINUMERIK PCU 50.3	
BIOS version	V05.01.06	
BIOS number	A5E00370214-ES005	
MPI/DP firmware	V01	
CPU type	Celeron ® M processor 1.50GHz	
CPU ID	06D8	
Code revision	0020	

Menu: Exit

Save Changes & Exit	All changes are saved; a system restart is carried out with the new parameters.

Changing BIOS settings

Once additional components have been installed or attached, it may be the case that the system has to be informed of this via the BIOS setup:

1. Ramp up the device.
2. When the prompt to activate the BIOS setup appears, press the <F2> key (corresponds to horizontal softkey 2 on the OP).
3. The BIOS setup menu appears. In the menu, use the cursor keys to navigate to the desired selection box.
4. Change the setting using the <+> key (press <SHIFT> and <X> at the same time) or the ↔ key on in the numeric keypad.
5. Using the left-right cursor keys, you can reach other setup menus.
6. Press <ESC> (<Alarm Cancel> key) to go to the "Exit" menu (or press the right cursor key again).
7. Press the <Enter> key to exit the setup menu.

Then the system powers up.

Note

Changes to the BIOS settings, with the exception of the boot sequence, require an OEM contract to be concluded.

1.5 BIOS settings for PCU 50.5

Overview

The BIOS of the PCU is preset in such a way that no changes are required. The date and time can be set under Windows or the operator interface.

NOTICE
Your device configuration is preset for working with the software supplied with the unit. You should only change the preset values if you have modified your device in any way, or if a fault occurs when the unit is powered up.

Starting BIOS setup

1. Start the BIOS SETUP as follows:

   Reset the device (warm or cold restart).

   After the first boot up, the following message appears:

   ```
   PRESS < F2 > to enter SETUP or <ESC> to show Bootmenu
   ```

2. Press the F2 key as long as the BIOS prompt appears on the screen.

   The BIOS main menu opens:

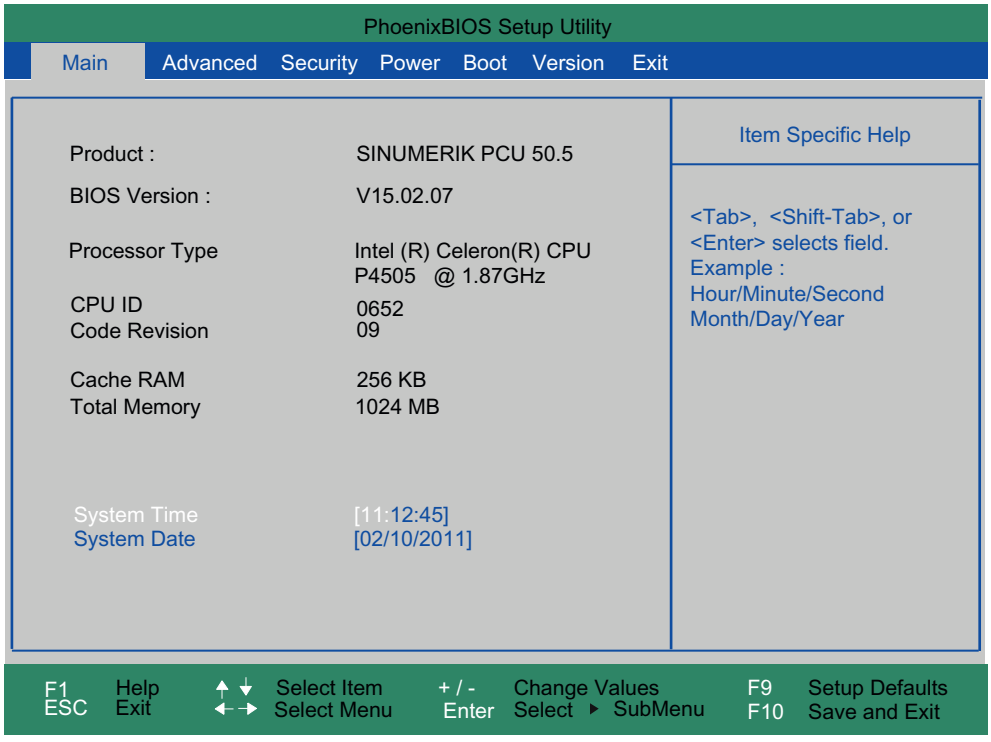


Figure 1-16 BIOS main menu PCU 50.5 (example)

BIOS setup: Default settings

The following system parameters are saved on delivery:

Menu: Main

System parameters	Default settings	Own entries
System Time	hh:mm:ss	
System Date	MM/TT/JJJJ	

Menu: Advanced

Peripheral Configuration	Default settings	Own entries
Internal COM 1	Enabled	
Onboard Ethernet 1	Enabled	
Onboard Ethernet 2	Enabled	
PCI - MPI / DP [1)]	Enabled	

[1)] only for CPB (-C)

SATA Configuration	Default settings	Own entries
SATA Controller	Enabled	
SATA Controller mode	AHCI	

Video Configuration	Default settings	Own entries
Primary video device	PEG	

USB Configuration	Default settings	Own entries
USB Port0	Enabled	
USB Port1	Enabled	
USB Port2	Enabled	
USB Port3	Enabled	
USB Port4	Enabled	
USB Port5	Enabled	
USB Port6	Enabled	
USB Port7	Enabled	
USB Port8	Enabled	
USB Port9	Enabled	
USB Port10	Enabled	

Chipset Configuration	Default settings	Own entries
Port 80h Cycles	LPC Bus	
VT-d	Enabled	
HPET	Enabled	

CPU Configuration	Default settings	Own entries
P-States (IST)	Enabled	
Turbo Mode	Enabled	
CMP Support	Auto	
HT Support	Auto	
Use XD Capability	Disabled	
VT Support	Enabled	
Turbo Mode	Disabled	
C-States	Enabled	

Active Management Technology Support	Default settings	Own entries
Intel AMT Support	Disabled	
Intel AMT Setup promt	Disabled	
AMT CIRA Request Trig	Disabled	
AMT DIRA Timerout	30	
Un-Configure ME	Disabled	
USB Configure	Enabled	

Advanced	Default settings	Own entries
Fan control	Enabled	
Operating Mode Switch	Enabled	

Menu: Security

System parameters	Default settings	Own entries
Supervisor Password	Not installed	
User Password	Not installed	
Set Supervisor Password	Inactive (no password assigned)	
Set User Password	Inactive (no password assigned)	

Menu: Power

System parameters	Default settings	Own entries
Wake on LAN 1	Disabled	
Wake on PME/LAN2	Enabled	
Wake on Time	Disabled	
After Power Failure	Power On	

Menu: Boot

System parameters	Default settings	Own entries
Quick Boot	Disabled	
Quiet Boot	Disabled	
POST Errors	All without keyboard	
NumLock	on	
USB Boot	Enabled	
Bootmanager	Enabled	
PXE Boot to LAN 1	Enabled	
PXE Boot to LAN 2	Disabled	

Legacy	Default settings	Own entries
Normal Boot Menu	Advanced Placeholder	

Menu: Version

System parameters	Default settings
Product	SINUMERIK PCU 50.5
BIOS Version	V15.02.07
BIOS Number	A5E02619467-ES001
InsydeH20 Version	03.59.53.1053
Intel ME Version	6.0.3.1203
Video Option ROM	1976
RAID Option ROM	9.5.0.1037
PXE Option ROM	1.3.30
Mode switch 0	Normal

Menu: Exit

System parameters	Default settings	Own entries
Exit Saving Changes	All changes are saved; a system restart is carried out with the new parameters.	
Profile	Standard	

Changing BIOS settings

Once additional components have been installed or attached, it may be the case that the system has to be informed of this via the BIOS setup:

1. Ramp up the device.
2. When the prompt to activate the BIOS setup appears, press the <F2> key (corresponds to horizontal softkey 2 on the OP).
3. The BIOS setup menu appears. In the menu, use the cursor keys to navigate to the desired selection box.
4. Change the setting using the <+> key (press <SHIFT> and <X> at the same time) or the ↔ key on in the numeric keypad.
5. Using the left-right cursor keys, you can reach other setup menus.
6. Press <ESC> (<Alarm Cancel> key) to go to the "Exit" menu (or press the right cursor key again).
7. Press the <Enter> key to exit the setup menu.

Then the system powers up.

Note

Changes to the BIOS settings, with the exception of the boot sequence, require an OEM contract to be concluded.

Boot sequence

BIOS version 05.01.12

In order to ensure correct functioning of the Software Ghost with Backup/Restore, please set in BIOS under "SATA/PATA Configuration" → "SATA Controller Mode" → "Compatible".

The CompactFlash Card is entered as SATA. The hard disk (or Solid State Drive) is DISK0, and the CompactFlash Card is DISK2.

See also

Select service task (Page 75)

Configuring the system

2

2.1 System settings

2.1.1 How to change the name of the PCU

Default

The PCU is supplied with an automatically generated computer name.

Procedure

To change the name of the PCU:

1. Select "Start" → "Control Panel" → "System".
2. Select the "Computer Name" tab and click on "Change".

   The following dialog opens:

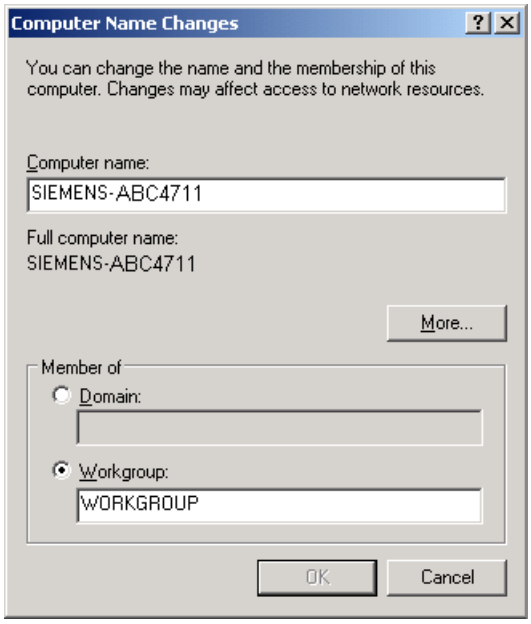


Figure 2-1 Changing the name of the PCU

2.1.2 This is how you set the IP address of the PCU

Default

NOTICE
The IP address 192.168.214.241 is set as a factory default for every PCU on the system network. You must only perform the steps described below if you wish to change this default.

Procedure

1. Select the following on the PCU on the service desktop: "Start" → "Settings" → "Network Connections".

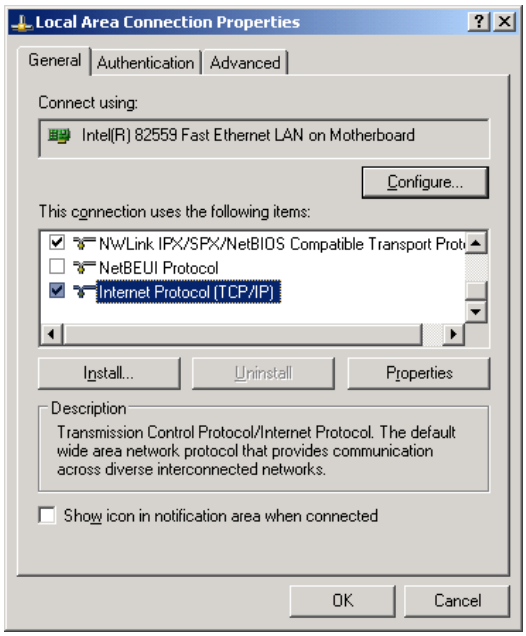
   The "Network Connections" window opens.

2. Double-click the Ethernet 2 interface you want to parameterize which is to be used for connecting the TCU or system network.

   The "Ethernet 2 (System Network) Properties" window opens.

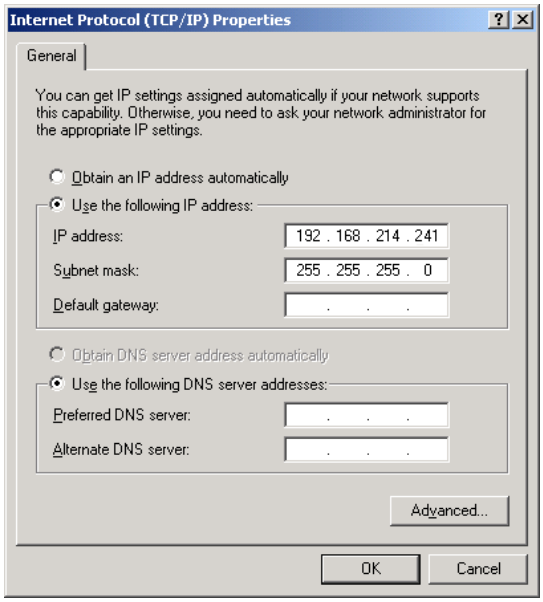
3. Under the "General" tab, select "Internet Protocol (TCP/IP)" and click the "Properties" button.

   The "Internet Protocol (TCP/IP) Properties" window opens:



4. Under the "General" tab, select the "Use the following IP address" option and enter the IP address and the subnet screen form.

   Recommended setting for the first PCU:



5. Enter the required new IP address and confirm the settings with "OK".

2.1.3 How to add the PCU to a domain

Requirement

Only a user with the corresponding entitlement, e.g. a domain administrator, can add a PCU to an existing domain.

Domain Controller (DC)

A domain controller (DC) is a server for central authentication and authorization of computers and users in a network. In a network with a domain controller, several computers are combined to form one domain.

Proceed as follows

To add the PCU to a domain:

1. Select: "Start" → "Settings" → "Control Panel" → "System", "Computer Name" tab.

   Default: The PCU belongs to a "WORKGROUP" and is not assigned to any domain.

2. Click "Change ...".

   The following dialog opens:

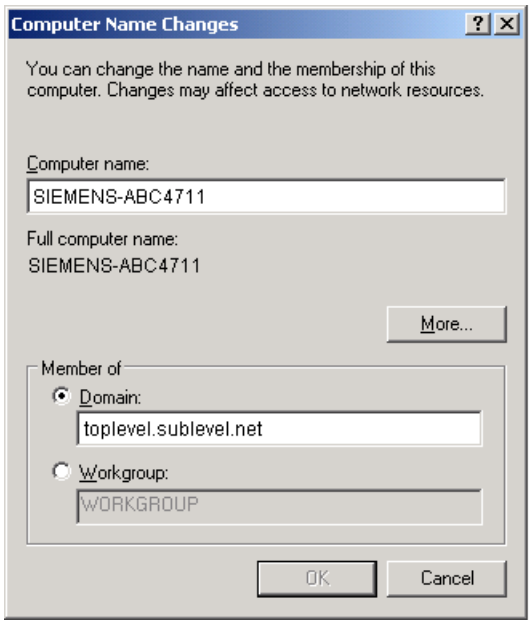


Figure 2-2 Add PCU to domain

3. Enter the name of the domain to which you want to add the PCU.
4. You will then be asked to log on as a user with the corresponding entitlement to conclude the process.

2.1.4 How to connect an external monitor

Preconditions

To connect an external monitor, the following preconditions apply:

- The external monitor is connected to the DVI interface on the PCU (using an adapter, if necessary).
- The monitor may not be connected while in use.

Procedure

To connect an external monitor:

1. Right-click the PCU's service desktop and select "Properties" from the pop-up menu.
2. Select the "Settings" tab and then click "Advanced".
3. Select the "Troubleshooting" tab and and set the "Hardware acceleration" to a value other than zero. The recommended setting is "full".
4. Close the dialog and click OK to confirm all the dialogs.
5. Repeat steps 2 and 3. There is an additional tab for "Intel(R) ... Grafics Controller"
6. Click the "Graphics Properties" button.
   - In the case of a PCU 50.3: On the "Devices" tab the external monitor corresponds to the "Monitor" selection; the OP/TP on the PCU corresponds to the "Notebook" selection. Select a "Primary Device" and a "Secondary Device".
   - In the case of a PCU 50.5: On the "Display" tab, the OP/TP on the PCU corresponds to the selection "Primary Display"; the external monitor corresponds to the selection "Secondary Display". Click the button "Multiple Displays" to select the "Clone" or "Extended" mode.
7. Close the dialog and click OK to confirm all the dialogs: The external monitor is now ready.

2.1.5 This is how you switch off the USB interfaces.

Command sc_usb disable

To prevent harmful software entering via the USB ports to the control or into the system network, you can switch off the USB interfaces.

This command is called up in the DOS shell:

Default setting:	The USB interfaces are not locked.
Syntax:	sc_usb disable [-minutes] [all] [HOSTS...]
	• Without a time indication [-minutes], a permanent disable is set. With time indication, the disable takes the time set in minutes.
	• The disable may refer to all network nodes of the system network, or a list of host names or IP addresses may be specified to which the disable should apply.

Command sc_usb enable

With "sc_usb enable" USB storage units on permanently disabled USB interfaces or on certain host names or IP addresses are enabled again.

2.2 Configuring a customized operator interface

2.2.1 How to select the language for the Windows system

Default setting

In the delivery condition, the Windows XP operating system is only installed on the PCU in English and with a US keyboard layout.

Requirement

In order to be able to switch languages, the desired languages must be installed from the DVD of the "SINUMERIK Service Pack Recovery Media Win XP ProEmbSys SP2". With the "Multilingual User Interface" (MUI), you can switch to menus, dialogue boxes and keyboard layouts for the Windows system in different languages:

⚠WARNING

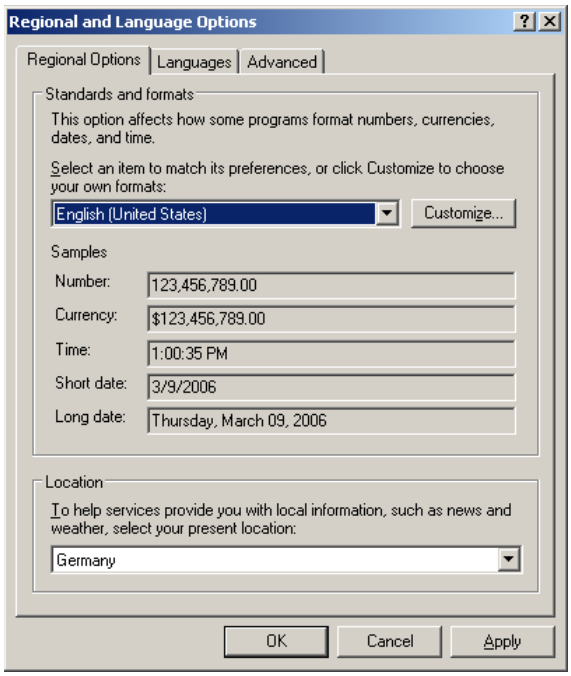
The settings for the keyboard assignment and the formats for date, time and number displays on the "Regional Options" tab **must not be changed under "Standards and formats"**.

These settings are automatically adapted depending on the language selected for the operating software.

Select a language

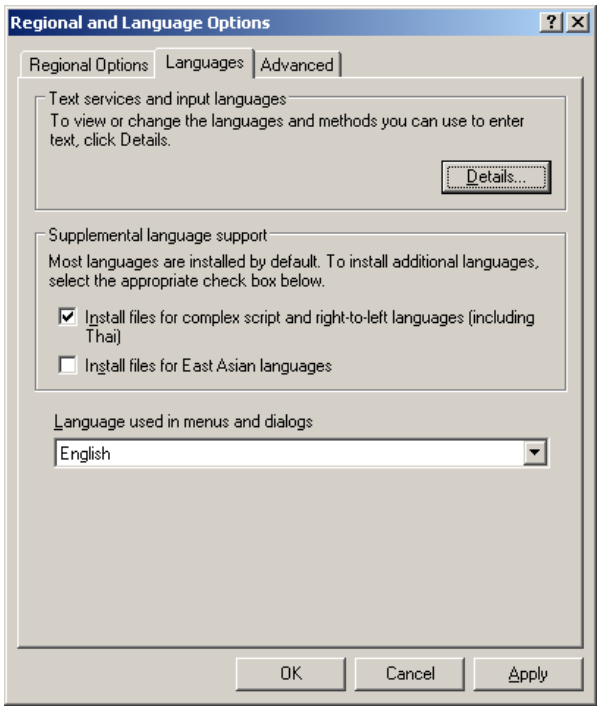
After installing a language from the corresponding CD, proceed as follows:

1. Choose "Start" → "Control Panel" → "Language and Regional Options", to open the following dialogue box:



This setting must not be changed!

2. Choose the "Languages" tab, in order to switch the language for the Windows XP operator interface. Under "Language used in menus and dialogues," choose the new language and confirm with OK.



3. On the "Advanced" tab, choose the language for programs that do not support Unicode.

Result

To make the language change effective, the PCU must be rebooted. The selectable languages are displayed using the font set of the respective language.

See also

How to install additional languages under Windows XP (DVD) (Page 69)

2.2.2 Displaying the boot screen

Default setting

The Siemens boot screen is archived in the PCU under the following path:

```
F:\hmisl\siemens\sinumerik\hmi\ico\ico640\splash.png
```

Display OEM-specific boot screen

You can choose any name.

The directory is set in ServiceCenter Users under:

- Startup: Bitmaps folder
- Startup: Default bitmap folder

2.2.3 Changing the background of the service desktop

Overview

A background pattern for the service desktop is not set via the "Control Panel" (system control), but in the registry:

- Background pattern:

Key:	HKLM\SOFTWARE\Siemens\SINUMERIK\Basic software\ <version>\HMI desktop
Value:	Pattern (STRING)
Date:	<bit code>" (e.g., "0 80 114 32 0 5 39 2", see HKCU\Control Panel\Patterns) "(None)" (= NO background pattern)
Init data:	Background pattern previously set via the Control Panel
Default data:	"(None)" (if entry is not available/readable)

- Background image:

  A background screen for the service desktop is not user-specifically set via the "Control Panel" (system control), but in the ServiceCenter Users under "Service: Bitmap Folders" or "Service: Default Bitmap Folders".

  Note

  An attempt to set the service desktop background (as in standard Windows) via the Control Panel does not affect the service desktop background display, but only the boot screen display.

2.3 Customized settings during boot up

Overview

Regarding the settings and functionality, booting followed by the start of an HMI program starting differs from booting with subsequent start of the Service Desktop.

2.3.1 Configuring key filters for an HMI program

Filtering keys

During boot up of an HMI program, keystroke sequences and pressed function keys are simultaneously filtered. The keystroke sequences and functions that were pressed simultaneously and are to be filtered are configured in file E:\Windows\System.ini.

Filtering keystroke sequences:

Section:	MMC103Keyb
Key:	SeqAct
Value:	<bit mask> (= keystroke sequences to be filtered, specified in accordance with the comment in E:\Windows\System.ini)
Init value:	262143

Filtering function keys that were pressed simultaneously:

Section:	MMC103Keyb
Key:	ConcurrentKeyMask
Value:	<bit mask> (= function keys to be filtered, specified in accordance with the comment in E:\Windows\System.ini)
Init value:	255

In the ServiceCenter Users, the keys that are to be filtered can be configured for each specific user:

- while the system boots → "Startup (2)" tab
- while the HMI program runs: → "HMI" tab
- on the Service Desktop or Windows Desktop: → "Desktop (2)" tab

system.ini file

```
# ------------------------------------------
# SIEMENS KEYBOARD-DRIVER SECTION (START)
# ------------------------------------------
# State of driver after startup
# (0=NORMAL, 1=PERMANENT-SHIFT ACTIVE)
keybStartState=0

# Type of Keyboard to be used
# (0=MMC103, 1=MFII)
keybType=0

# Filtering Key Sequences
# =======================
# Activation of Key-Sequences to be ignored
# SeqAct holds a BIT-Pattern for a max of 20 sequences
# which could be ignored by the keyboard-driver
# if bit-n is set in Seq-Act, the according sequence
# will be ignored
# The following 20 sequences are implemented
# 0 CTRL-ALT-DEL
# 1 ALT-F4
# 2 ALT-TAB
# 3 LEFTSHIFT-ALT-TAB
# 4 RIGHTSHIFT-ALT-TAB
# 5 CTRL-ESC
# 6 ALT-ESC
# 7 ALT-SPACE
# 8 (SHIFT)-CTRL-F1
# 9 (SHIFT)-CTRL-F2
# 10 (SHIFT)-CTRL-F3
# 11 (SHIFT)-CTRL-F4
# 12 (SHIFT)-CTRL-F5
# 13 (SHIFT)-CTRL-F6
# 14 (SHIFT)-CTRL-F7
# 15 (SHIFT)-CTRL-F8
# 16 M$_1
# 17 M$_2
# 18 CAPSLOCK
# 19 NUMLOCK
# 20 (reserved)
KeySequencesEnable =1
```

```
SeqAct=262143

# Filtering Concurrent Keys
# ========================
# Definition and selection of function keys (buttons) which shall not be
# pushed in parallel or at the same time (function keys F1-F12 and
# additional hardkeys).
# If more of these buttons are pushed at the same time, the system removes the
# code of these buttons except the code of the button which was pushed first.
# This function of the keyboard-driver is activated by ConcurrentKeyEnable.
# ConcurrentKeyMask holds a BIT-Pattern for a max of 17 function keys, which
# must not be pushed simultaneously (concurrently). If bit-n is set in
# ConcurrentKeyMask, the corresponding button is supervised.
# The following 17 function keys are implemented:
# F1
# F2
# F3
# F4
# F5
# F6
# F7
# F8
# F9
# F10
# F11
# F12
# PAGE-UP (NUMLOCK) Alarm Hardkey on Operator Panel
# PAGE-DOWN (NUMLOCK) Tool Management Hardkey on Operator Panel
# HOME (NUMLOCK) Program Manager Hardkey on Operator Panel
# END (NUMLOCK) Program Hardkey on Operator Panel
# CURSOR-DOWN (NUMLOCK) Alarm Hardkey on Operator Panel
```

Note

Scope of the keys

Only keys, which have already been defined in the system.ini file, can be enabled.

No additional keys can be defined for filtering.

See also

ServiceCenter Users: User settings (Page 12)

2.3.2 Saving service desktop settings

Starting the service desktop

The Windows platform is freely accessible via the service desktop. When the service desktop is started, all of the programs that would automatically be started by Windows (standard version) during log-in are also started.

- **Executing an HMI program**

  The HMI program can also be started from the service desktop.

- **Ending an HMI program**

  When an HMI program started from the service desktop is exited, you are returned to the service desktop.

Saving the service desktop (default)

The settings on the service desktop (e.g. arrangement of the links on the service desktop) are not saved when you log off. A service technician should always find the same starting condition on the service desktop, not the settings from a previous session.

Saving the settings of the service Desktop

This behavior can be changed by making an entry in the registry. The following settings can be saved via this registry entry:

- Positions of open windows
- Size and position of the task bar
- Moving and deleting links

Key:	HKLM\SOFTWARE\Siemens\SINUMERIK\Basic software\ <version>\HMI Manager
Value:	SaveSINDesktopSettings (DWORD)
Date:	1 (the settings are saved) or 0 (the settings are NOT saved)
Init data:	- Value is not created by the basic software -
Default data:	0 (if entry is not available/readable)

The key is effective for all service users and other users.

Links on the service desktop are always saved, irrespective of the registry entry.

Note

Application windows that are still open before logging out, must be closed by the setting "Save settings" before exiting the service desktop. Otherwise, these application windows will briefly be displayed and then closed again during a restart immediately before the HMI program starts.

2.3.3 Starting programs during boot up

Starting additional programs

Programs can also be started at the same time as the HMI program and are started automatically by Windows when the service desktop is opened. This start in parallel to the HMI program can be configured.

If the programs to be started are located in the Windows directories of E:\Documents and Settings, the following registry entry must be set:

Key:	HKLM\SOFTWARE\Siemens\SINUMERIK\Basic software\ <version>\HMI Manager
Value:	StartSINHMIStartupDirsPrograms (DWORD)
Date:	1 (the programs are started) or 0 (the programs are NOT started)
Init data:	0
Default data:	0 (if entry is not available/readable)

If the programs to be started are set in the registry entries 'HKCU\Software\Microsoft\Windows\CurrentVersion\Run' and 'HKLM\Software\Microsoft\Windows\CurrentVersion\Run', the following registry entry must be set:

Key:	HKLM\SOFTWARE\Siemens\SINUMERIK\Basic software\ <version>\HMI Manager
Value:	StartSINHMIRunPrograms (DWORD)
Date:	1 (the programs are started) or 0 (the programs are NOT started)
Init data:	0
Default data:	0 (if entry is not available/readable)

Executing an HMI program

While the HMI program is being executed, Windows Explorer runs in the background and its settings (disabled browser functionality, taskbar, start menu, ...) prevent the Windows platform being accessed unintentionally.

The behavior of the taskbar can be user-specifically set in the ServiceCenter Users under "HMI program" using "Taskbar Autohide" and "Taskbar On Top".

Ending an HMI program

When the HMI program is ended, Windows XP shuts down completely.

2.3.4 Starting OEM programs

Overview

You can start OEM programs directly before starting the HMI system software. This requires these programs (or their links) to be stored in subdirectories of the directory C:\RunOEM.

Starting sequence

The subdirectories are executed in the order listed. The programs within a subdirectory are started in the chronological order in which they were placed in the subdirectory.

- Programs in the C:\RunOEM\SeqOnce subdirectory are started **once and sequentially**, i.e., a program is not started until the previously started program is completed.
- Programs in the C:\RunOEM\Seq subdirectory are started **sequentially whenever the system is ramped up**, i.e., a program is not started until the previously started program is completed.
- Programs in the C:\RunOEM\ParOnce subdirectory are started **once and simultaneously**. They run parallel with the HMI system software.
- Programs in the C:\RunOEM\Par subdirectory are started **simultaneously whenever the system is ramped up**. They run parallel with the HMI system software.

Not only program files, but also other types of file can be stored in the subdirectories, which are then opened in accordance with their file type.

For example, ".txt" files are opened using Notepad, ".htm" files are opened using Internet Explorer.

2.3.5 Starting applications in service mode

Starting other applications

If other applications are to be started in service mode, enter them with their complete path in the [OEMRun] section in the file WINBOM.INI:

Example: Starting the "Notepad" program

```
[OEMRunOnce]

"Start WinVnc", "x:\I386\system32\StartWinVnc.exe"

"Check Password","x:\I386\system32\CheckPEPwd.exe"

[OEMRun]

"Start Backup/Restore", "x:\I386\system32\GhostOrder.exe"

"notepad","e:\windows\notepad.exe"
```

All other entries must not be changed.

2.4 PCU with SITOP UPS module

Preconditions

- Valid for PCU 50.3 and PCU 50.5.
- SITOP software, version 3.1.0.6or higher is installed:

  SITOP software is available to download from: www.automation.siemens.com/sitop
- SITOP monitor/configuration program is installed:

  To enable this, the SITOP software must be copied to the E:\SITOP directory set up on the PCU. This directory already contains PCU tools required for shutdown on the SITOP UPS. If this directory does not exist in an older version of the PCU-Basesoftware, it must be created so that it will be compatible for any subsequent updating of the PCU-Basesoftware.
- UPS USB driver for Windows XP is installed:

  Installation is described in the relevant SITOP documentation. The documentation is part of the SITOP software download package.
- The SITOP UPS hardware is connected.

NOTICE
The SITOP software version 3.1.0.6 can be operated with PCU-Basesoftware Windows XP subject to the following conditions: • SITOP software must not be installed as a Windows service, but must be started as a normal application (as described in the chapter titled "Starting and configuring the SITOP monitor"). • The SITOP service prevents the correct switch-off procedure being performed on the SITOP UPS module when PCU-Basesoftware is installed.

Application

If the supply voltage at the PCU dips, the SITOP UPS modules below could maintain operation for a limited period if a backup battery is being used, allowing the PCU to be properly shut down before the battery is exhausted.

Designation	Order number
SITOP with USB interface	MLFB:
• SITOP DC UPS module (24 V / 15 A)	6EP1931-2EC42
• SITOP battery module 3.2 Ah	6EP1935-6MD11
• SITOP UPS 500S basic module (2.5 kWs)	6EP1933-2EC41
• SITOP UPS 501S expansion module (5 kWs)	6EP1935-5PG01

For a safe shut down during a power failure, it takes the PCU approx. 60 seconds. For a typical power consumption of approx. 60 W, a capacitor-buffered UPS with an energy storage device of 7.5 kWs is recommended. If longer buffer times are required, then several expansion modules can be connected in a cascade connection.

Note

Information about the test environment for machine OEMs

The "SITOP UPS" function has been tested in the standard configuration with the operating software. When installing add-on or OEM software components, the shutdown procedure of the complete system has to be checked by the user.

For additional information, please refer to the KT10.1 Catalog.

2.4.1 Starting and configuring the SITOP monitor

Windows boot up

The SITOP monitor has to be started by Windows automatically during ramp-up: Activate this setting when installing the SITOP software in the dialog "Configuration - default settings for the SITOP Software". Select the option "Start program with Windows". After the PCU has restarted, the SITOP monitor is then automatically started. The next installation step is to configure the monitor.

NOTICE
The SITOP monitor must not be started via the Windows Autostart directory.

General settings

The following settings must be made in the SITOP monitor configuration dialogue box:

- Parameterization of the interface: For module with USB port
- Parameterization of the change action:

  The monitoring window display must be deselected, as this function can lead to sporadic faults on the HMI operator interface.

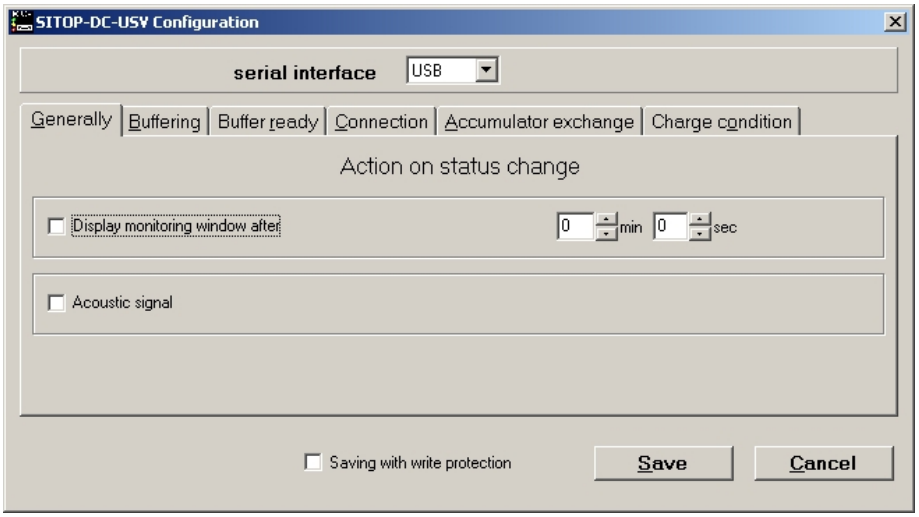


Figure 2-3 Configuration of the SITOP monitor: General settings

Parameterization of the SITOP monitor

Enter the path of the program that ensures that HMI Advanced and the PCU shut down properly in the event of a power failure into the parameter area of the buffer.
E:\SITOP\Shutdown.bat

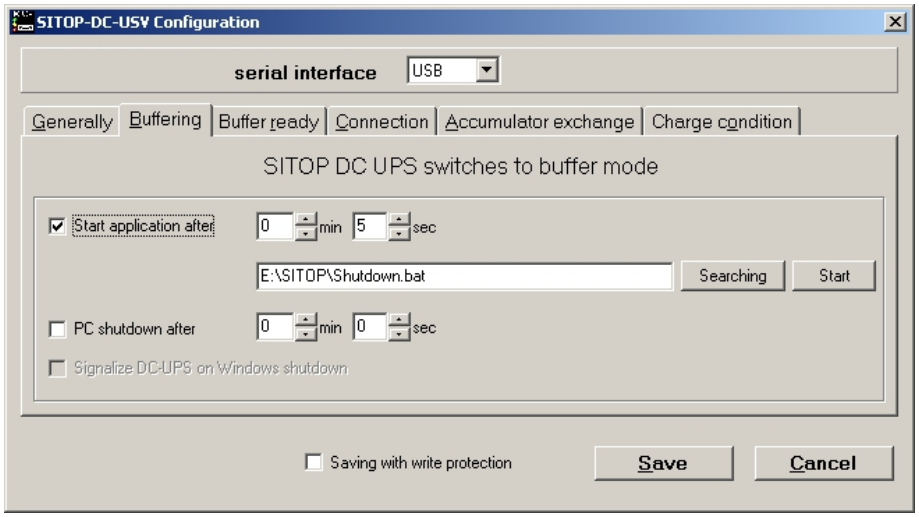


Figure 2-4 Configuration of the SITOP monitor: Buffering settings

Alternatively, the following setting can be used: E:\Windows\system32\hmiexit.exe

2.4.2 Configuration of the SITOP UPS module

Buffering parameterization

The UPS module can be used to select whether buffering should be completed after a predetermined period of time or not until the accumulator's lowest discharge threshold (= maximum buffer time) has been reached. Both buffering parameterizations result from this.

"Maximum buffer time" mode

This mode enables the system to be shut down in a time-optimized manner. The UPS module is synchronized with the shutdown of the operating system. Buffering is maintained until the operating system has been shut down. The operating system must shut down within a maximum of five minutes (including all applications). Otherwise, the UPS module buffers for the maximum buffer time (dependent on the accumulator state).

Required settings on the UPS module (USB interface)

	On - Off			
1		●	+2V	Cut-in threshold +22V fixed
2		●	+1V	
3	●		+0.5V	
4		●	+1V	End-of-charge voltage + 26.3V fixed
5		●	+1V	
6	●		+0.5V	
7	●		+0.2V	
8		●	+0.2V	
9		●	+0.1V	
10		●	0.35A / 0.7A	Charging current

	On - Off			
1		●		Set time/max. time
2		○	+320 s	Buffer time +5 s fixed
3		○	+160s	
4		○	+80s	
5		○	+40s	
6		○	+20s	
7		○	+10s	
8	●			Disconnection
9		○		Battery operating state on/off

Legend:

○ Delivery condition setting

● Setting for operation on the PCU

"Fixed buffer time" mode

In this mode, the UPS module always buffers for the pre-selected, fixed period of time. It is not possible to synchronize the UPS module with the operating system shutdown.

Required settings on the UPS module

	On - Off			
1		○	+2V	Cut-in threshold +22V fixed
2		○	+1V	
3	○		+0.5V	
4		○	+1V	∘ ∘ End-of-charge voltage + 26.3V fixed
5		○	+1V	
6	○		+0.5V	
7	○		+0.2V	
8		○	+0.2V	
9		○	+0.1V	
10		○	0.35A / 0.7A	Charging current

	On - Off			
1	●			Set time/max. time
2		○	+320 s	°
3	●		+160s	°
4		○	+80s	Buffer time
5		○	+40s	+5 s fixed
6		○	+20s	
7		○	+10s	
8	●			Disconnection
9		○		Battery operating state on/off

Legend:

○ Delivery condition setting

● Setting for operation on the PCU

2.4.3 Configuration for exiting the operating software

HMI monitoring

Exiting the operating software is monitored via an own hmiexit.exe application. This application is started implicitly via the shutdown.bat batch file. In case of error, the application forces the operating system to shut down. An error occurs if the HMI cannot be exited within the configured delay.

Optionally, the parameters below can be set for hmiexit in file:

```
E:\SITOP\hmiexit.ini.

[Actions]

#Waiting time in seconds for closing HMI Advanced applications

Wait = 120

# Action on expiration of the waiting time

ForceShutdown = True
```

These default settings only need to be changed if it takes longer than 120 seconds to exit the HMI applications in an OEM installation. This configuration is not usually changed.

Configuring the "EXIT" softkey

During production, the option to shut down the HMI via the "EXIT" softkey in the operating area menu should be disabled, as this function cannot be synchronized with the UPS module.

The "EXIT" softkey is disabled by entering ExitButton=False in the regie.ini file.

Hibernate

The operating system's hibernate mode is suspended when operating the UPS, as the USB interface always has to be active for the UPS module.

Note

More information can be found in the product descriptions with the corresponding order number.

Install software and updates

3

3.1 Installing SINUMERIK products

Overview

This chapter describes how to install additional software on the basis of the pre-installed PCE basic software or how to carry out an update.

The description below is based on the delivery condition of the hardware and software components.

The service desktop is, for example, used for the following tasks:

- Installing HMI system software
- Setting the running environment of the HMI system software
- Checking the hard disk or version
- Privilege for SIMATIC STEP 7

3.2 Installation via service desktop

Installing additional software

The service desktop makes it possible to install system software or a software update. This mostly affects installation/update packages that are to be installed via the Windows network.

Installation can be performed in two ways:

- The installation/update package is stored in directory D:\INSTALL. When booting the PCU the next time, the installation/update process is automatically started while booting. Only when the installation or update process is completed does normal boot manager continue and, if necessary, HMI software started.
- The installation/update process can be started from the service desktop directly by executing the installation/update package.

Using installation directories

Several installation directories can be set to enable an operator setup to be executed automatically. Installation directories include the subdirectory D:\Install and the directories listed in the [SetupDirs] section of the E:\Windows\System32\HMIServe.ini parameters file.

The "D:\Install" installation directory is preset there.

The key names contained within a section of the E:\Windows\System32\HMIServe.ini parameters file must be unique.

The installation directories are evaluated in the sequence described in the parameters file. If the parameters file is missing or it does not contain a [SetupDirs] section, the preset "D:\Install" installation directory is considered instead.

If the [SetupDirs] section contains installation directories, but not "D:\Install", the "D:\Install" directory is not considered within the context of the set installation directories.

When executing a setup using OpFile.txt, the issue of whether or not the setup requires a reboot once it has been completed is taken into account and displayed via a corresponding OpFile.txt entry. If a corresponding entry exists, a reboot is triggered. If there is a chain of setups to be executed one after the other, the reboot is performed once the final setup is complete.

Installing with HMI Explorer

The "HMI Explorer" Windows program is available on the service desktop. When this program is called up, detailed version information relating to the HMI system software applications installed and to Windows XP is displayed.

Applications can be individually started or uninstalled via the HMI Explorer. Select the menu "Install" to display and install the available software packages.

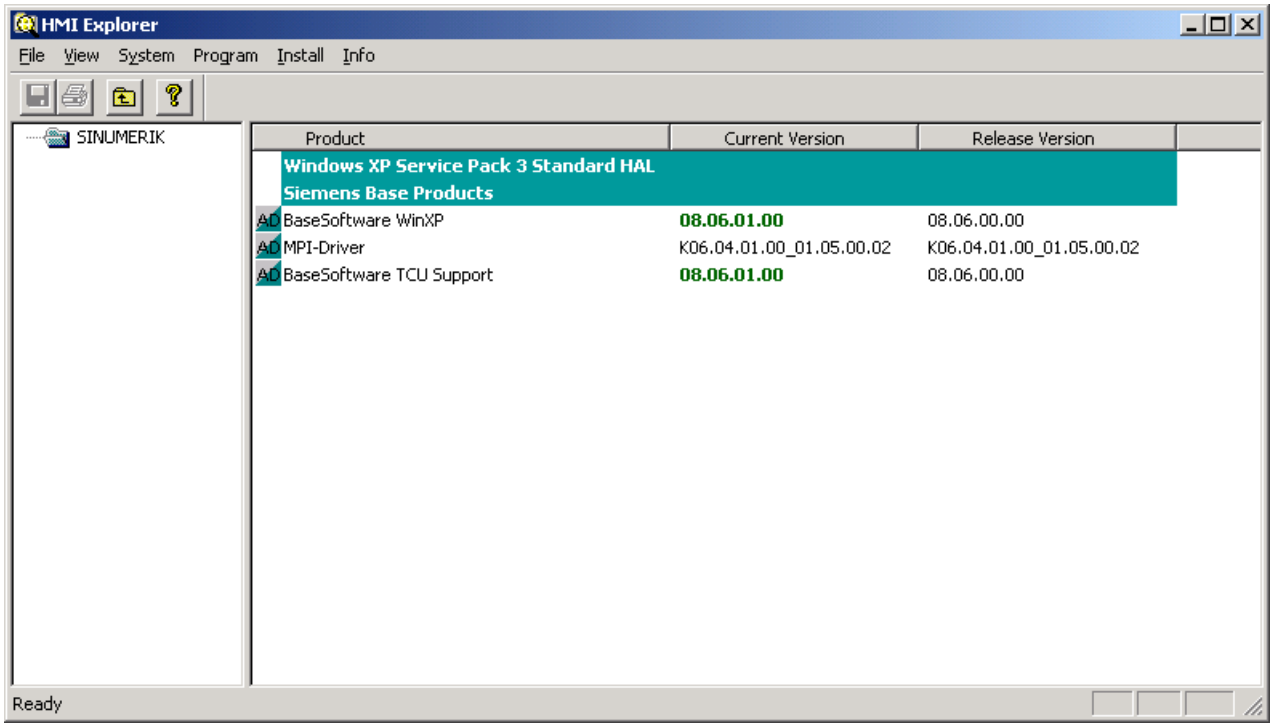


Figure 3-1 HMI Explorer (Example)

Description of HMI Explorer

The properties dialogue box gives detailed information on installing the software product:

- **Information on the SINUMERIK product:**

  The "Info" dialogue box provides information on the selected SINUMERIK product:

Current version:	Specifies which version of the SINUMERIK product is currently installed. The version is shown in long form.
Internal version:	Shows the current internal version number of this product.
Installation Date/Time:	Shows the installation date and time of the current version.
Installation path:	Displays the path for the main directory of the SINUMERIK product.
Start application:	Gives information on the path to the *.exe file, which launches the SINUMERIK product.

- **Language of the product**

  The "Language" dialogue box lists the installed languages for the respective SINUMERIK product and provides information on the name of the installed language. If the language is not known, an abbreviation of its name is displayed. Known languages of HMI Explorer are German, English, Spanish, French and Italian. The version of the installed language is also displayed. Information is also given regarding the installation time and date.

- **History of the product**

  The "History" dialogue box shows information on the history of the SINUMERIK product. This dialogue box gives information on the release version, any service packs and hot fixes. The "release" entry is always available. The entries for "service pack" and "hot fix" only appear if they have been installed. Information on the "version", "internal version" and "installation date/time" is given for each entry on this list.

- **Component information**

  The "Components" dialogue box shows the information on the components accompanying a product:

Component:	Component name
Version:	Internal version of the components
Path:	Path of the components
File:	*.exe file
Enable :	Shows whether or not the component is enabled
Description:	Description of components
Type:	Type of components

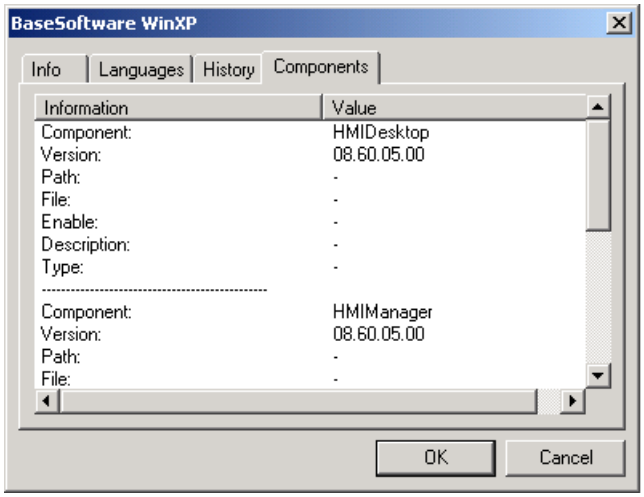


Figure 3-2 "Components" dialogue box (example)

3.3 How to install and authorize SIMATIC STEP 7

Overview

SIMATIC STEP 7 V5.5 SP1 can also be installed on the PCU.

Delivery item:	SIMATIC STEP 7 V5.5 SP1
Components:	SIMATIC STEP 7 V5.5 SP1 and AddOn for SINUMERIK 840D sl
Type of delivery:	1 installation DVD

Note

The "MPI driver" package available on the PCU is part of the HMI software and must not be uninstalled!

A network connection or a connection to a DVD drive is required.

Recommendation: Mouse port

Installation under Windows XP

You must follow the installation sequence described here!

1. Boot up the PCU in the service desktop.
2. Access DVD (via network or external DVD drive) and call up SETUP.EXE in the root directory there.
3. The installation proceeds with operator prompting. The installation directory for STEP 7 should be changed to F:\... where the directory in F: can be freely selected.
4. The prompt for "Transfer license keys" must be answered with "No, transfer the license keys later." The licensing is done after the installation of SINUMERIK add-on. Once installation is complete, the PC will need to be rebooted. During boot up, select the service desktop again.
5. Switch to the Sinumerik_Add_on directory on the DVD and call SETUP.EXE. The installation proceeds with operator prompting. Once installation is complete, the PC will need to be rebooted. During boot up, select the service desktop again.
6. Start the link "STEP7 authorizing" on the service desktop. This authorizes STEP 7 and it can be started from the operating software (STEP 7 appears as its own operating area on the expansion bar of the area menu, protected with access level 3).

The following entries are made automatically in F:\Add_on\oemframe.ini:

```
[s7tgtopx]
; with HMI Advanced: eliminate minimize/maximize buttons
; of the Step7 window
WindowStyle_Off=196608
; with HMI Advanced: switch to previous task when Step7 is terminated
nSwitchToTaskAfterTermination= -2
```

These entries may also need to be modified in OEM configurations.

3.4 How to install additional languages under Windows XP (DVD)

Use

Use the SINUMERIK service pack recovery media WIN XP ProEmbSys SP3 to:

- Subsequently install Windows components
- Re-establish the delivery condition of the PCU **without application software**
- To install other languages for Windows XP

Contents of the DVD

There are the following directories on the DVD:

Directory	Contents
1_WIN_Components	Windows XP ProEmbSys SP3 Windows XP ProEmbSys operating system, incl. SP3 for post-installation of software components that are no longer located on the PCU.
2_XP_Base	Symantec Ghost image for PCU 50.3 and EBOOT • Ghost image of the delivery condition of the PCU basic software Windows XP for PCU 50.3 without application software. • Ghost image for creating an "Emergency Boot System" (identical to the directory D:\EBOOT on the PCU)
3_MUI_1	Chinese (simplified) Traditional Chinese Japanese Korean Romanian Slovakian
4_MUI_2	Danish German French Dutch Italian Spanish Swedish
5_MUI_3	Brazilian Portuguese Finnish Polish Russian Czech Turkish Hungarian

Directory	Contents
EULA TERMS	Contained
Certificate of authenticity	Not contained

Installing languages

To install additional languages, proceed as follows:

1. If no DVD drive is directly connected via a USB port, the DVD can be accessed via a network to a released DVD disk drive via "Explorer" → "Tools" → "Map Network Drive". The letter G should be selected as the drive letter.
2. Select the directory with the appropriate language, the program "MUISETUP.EXE" starts. After accepting the licensing conditions, you can start the installation procedure with "Continue". A list of all of the pre-installed languages and the languages available on the DVD is displayed.
3. Now the desired languages can be installed/uninstalled by inserting or deleting a check mark in front of the language.
4. Other settings include:
   - Choice of language version for the standard user/new user
   - The language for programs without Unicode support must be set to "English (US)".
   - The font set must also be set to "English (US)".
5. After confirming with "OK," the installation begins. Many languages (e.g. Chinese) require system files that are also located on the DVD.

   If the installation drive is other than the recommended "G:" the "Windows XP Professional Service Pack 2 CD" or the "Windows XP Professional CD" may be required. The path name must then be changed accordingly.
6. After successful installation, a reboot may be requested depending on the language.

Note

- The choice can only be made from among the languages that were previously installed on the PCU.
- The new language of Windows XP only goes into effect if the user logs in again after the changeover or the PCU is turned off and then on again.
- The language setting of the operating software is independent of this. It is set independently of this under "Start-up" → "HMI" → "Change Language".

Backing up and restoring data

4

4.1 Backing up and restoring data

Overview

The entire contents of hard disks can be saved as a disk image using the Symantec Ghost utility. These disk images can be stored on various storage media and the data restored to the hard disk at a later date.

PCU replacement hard disks and complete PCU hard disks are supplied by the plant with Symantec Ghost already installed. Symantec Ghost is used for the data storing and restoring processes described in the following sections.

More information is available on the Internet at: http://www.ghost.com/

4.1.1 How to create a service system for PCU

Use

In case servicing is needed, create a portable service system as an "Emergency Boot System" (EBS) on a USB memory store on the basis of WinPE.

Recommendation:

It is better to use SIMATIC PC USB-FlashDrive.

Creating a service system

The Ghost image is available on the hard disk under D:\Eboot in order to create the service system for a PCU on a USB memory.

Use the following procedure:

1. Start the PCU in the service mode.
2. Plug a USB memory with at least 256 MB into a PCU USB port.
3. Launch Ghost32.exe in directory E:\Tools
4. Select Ghost: Local → Disk → From Image. As the source, select D:\Eboot\eboot.gho and as the destination select the USB memory store (recognizable by its storage capacity).

   Result:

   After successfully transferring eboot.gho to the USB memory store, the service system for the PCU is ready to use.

Using the same procedure, create a service system on a PG/PC. For this, the Symantec Ghost program must be installed on the PG/PC.

Booting up the service system

1. Plug the EBS into one of the USB ports of the PCU.
2. Press the <ALARM CANCEL> key on the operator panel or the <ESC> key on an external keyboard while the BIOS of the PCU is booting up in order to display the "Boot Menu".
3. Select the entry "USB-HDD: XXX " from the list of available media.

   Result:

   The PCU boots up from the service system and the ServiceCenter starts.
4. First select "Start" to start the ServiceCenter and then "Backup/Restore Disk Image", to restore the hard disk using the disk image.

NOTICE
During booting: • The boot-up of the PCU from the EBS via the front USB interface (=USB V1.1; rear USB V2.0) of a directly connected OP is also possible but it is considerably slower. • It is not possible to boot up the PCU from the EBS via the USB interface of a TCU. • It is not possible to save network settings on the EBS. • VGA mode is only possible via a DVI → VGA adapter.

Booting the service system in the headless mode

Precondition: the PCU is installed in the control cabinet and is only operated with a TCU that has no OP/TP.

For a PCU 50.3 with BIOS version 05.01.11:

- After locking the hard disk, you can boot up from the USB service system and power up using WinPE.
- Then release the hard disk again and proceed in the manner described above.

For a PCU50.5 :

Set the service switch to "**E**", if you wish to boot the PCU 50.5 from the USB service system.

See also

How to backup and restore the hard disk (Page 78)

Setting of the service switch (PCU 50.5 only) (Page 96)

4.1.2 Starting ServiceCenter Backup Restore

Starting ServiceCenter Backup Restore

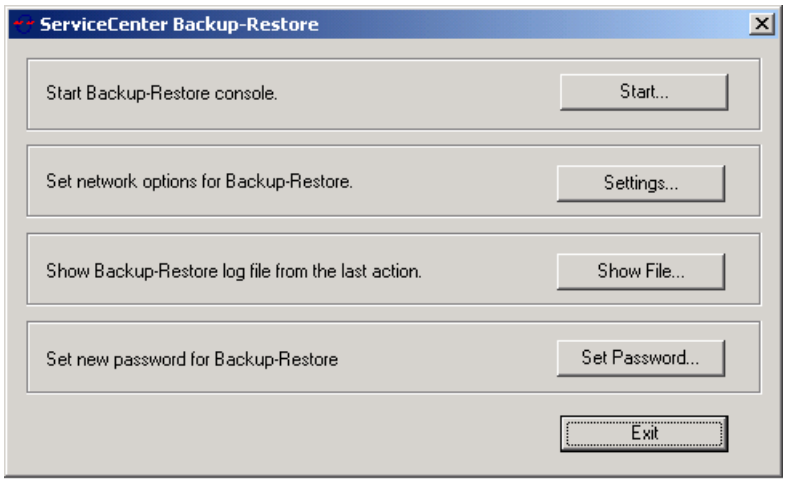
You start the ServiceCenter Backup Restore for the following tasks:

- Backing up/restoring data
  - Starting via linking from the service desktop
  - Starting during boot up via entry in the "background" under SINUMERIK
- From the service system in the event of service
- When installing a replacement hard disk

In order to ensure that the user is authorized to carry out service tasks, direct access is password-protected during boot up of the PCU. This password can be changed.

NOTICE
If you start the ServiceCenter Backup Restore via the service desktop from a service system or when installing a replacement hard disk, no password is needed.

The following dialog appears after you double-click the ServiceCenter Backup Restore link on the service desktop:



Start ...	With "Start," you start the shutdown of the system and the start of the ServiceCenter.
Settings ...	With "Settings," you open the dialogue box for network settings.
Show File ...	Under "Show File," you can view the log of the last data back up.
Set password ...	This is where you enter a new password for ServiceCenter Backup Restore. (the default is the same as for the service user "auduser".)
Exit	Cancel and return to the service desktop.

Figure 4-1 Starting service

Network settings

1. To connect the PCU to a programming device or PC, choose "Settings" in order to check or reset the set IP addresses.
2. Select "Use Windows settings", to keep the factory defaults. (This is the default here as well.)

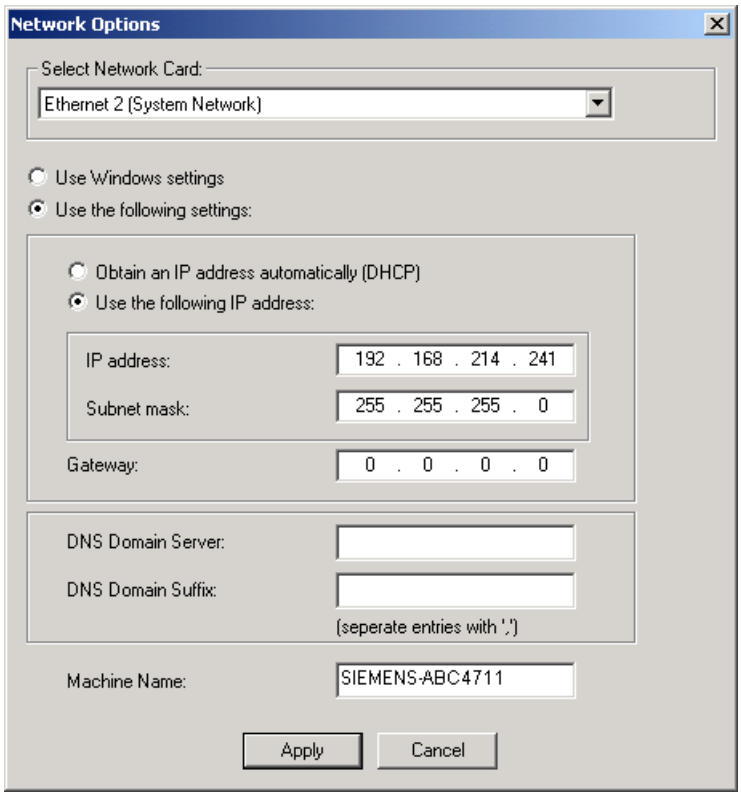


Figure 4-2 Network settings

3. Select "Use the following settings", to set a new configuration:
   - With "Obtain an IP address automatically (DHCP)," you receive an automatically assigned IP address from your DHCP server.
   - With "Use the following IP address," you enter an IP address in the range of 192.168.214.250 – 254 using subnet screen form 255.255.255.0.
4. To activate a DNS name service, specify the server's IP address under "DNS Domain Server" and the extension, e.g. "network.com" under "DNS Domain Suffix".

   The default is ".local" if you don't enter anything else.

Note

Changes to the network settings that you make here only become effective after you reboot the PCU.

On the other hand, if you make changes to the network settings from service desktop, they are immediately adopted.

See also

System features (Page 8)

4.1.3 Select service task

Selecting the service task

After start-up of the ServiceCenter, the following dialog opens:

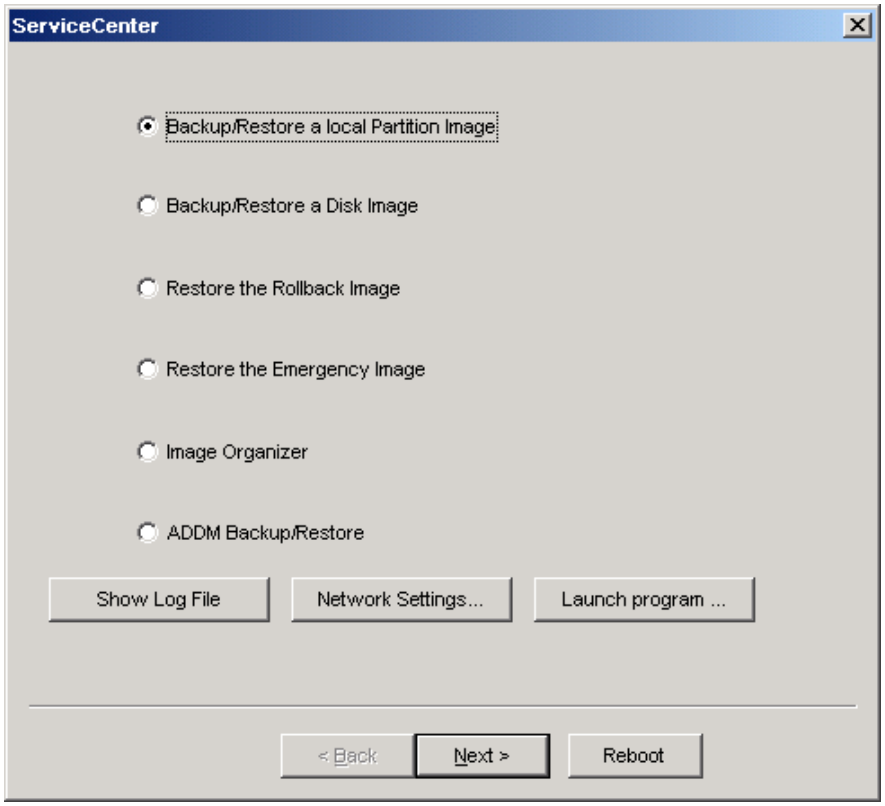


Figure 4-3 ServiceCenter Selection

Select from the following service tasks:

- Backup/Restore a local Partition Image
- Backup/Restore a Disk Image
- Restore the Rollback Image
- Restore the Emergency Image
- Image Organizer

NOTICE
Backup/Restore with CompactFlash Card If a CompactFlash Card is present in the slot of the PCU, a Backup/Restore via the service menu is not possible. In this case, the program "ghost32.exe" must be started and operated manually from the service menu.

Show log file

This option opens file bacres.txt, which contains a log of all backup records.

Network Settings

With "Network Settings," you open the dialogue box for network settings.

Launch Program

To start a program in service mode, enter the program name here, e.g. "cmd" for starting a DOS shell.

4.1.4 How to backup and restore local partitions

Backing up partitions

1. Select the "Backup" action from "Backup/Restore a local Partition Image" to backup an image of one or more C, E, and F partitions locally on the D:\Images partition of the hard disk:

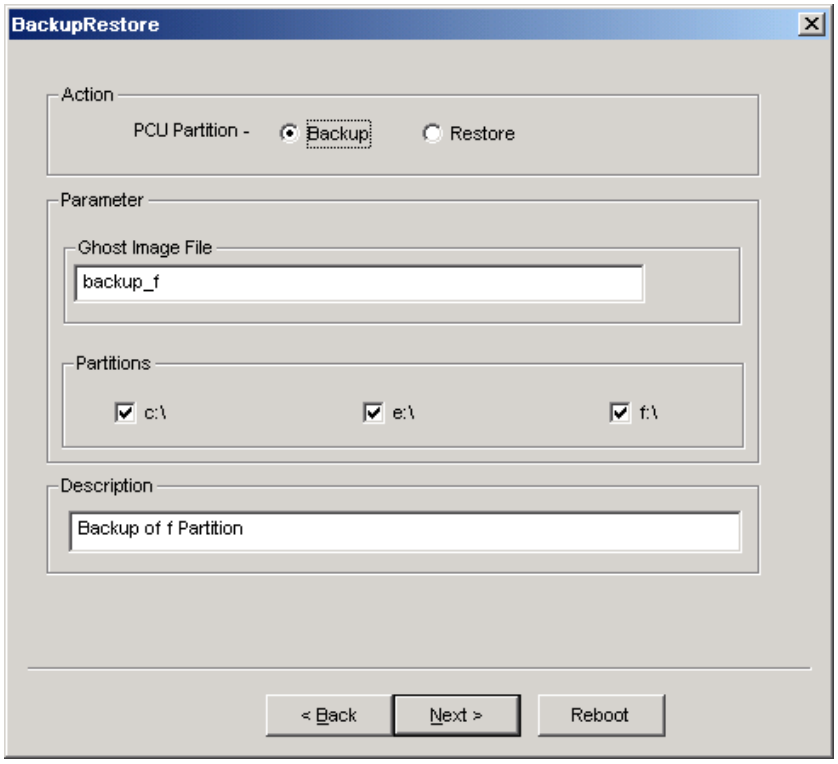


Figure 4-4 Local Partition Backup

2. Select the partitions for which an image is to be produced.
3. Before the backup is started, the size of each partition will be displayed in the next dialogue.

   Recommendation:

   If you wish to save the backup file and restore it later, we recommend that you always create a complete image of partitions (C, E and F).

Restoring partitions

Select the "Restore" action from "Backup/Restore a local Partition Image" to restore an image of one or more C, E, and F partitions locally from the D:\Images partition:

Restore the Rollback Image

To restore the most recently saved image, namely the current image ("Rollback Image"), select "Restore the Rollback Image".

The "Rollback Image" is the last created back-up of a partition.

4.1.5 How to backup and restore the hard disk

Backing up the hard disk

Select "Backup/Restore a Disk Image" to backup an image of the hard disk using the network connection:

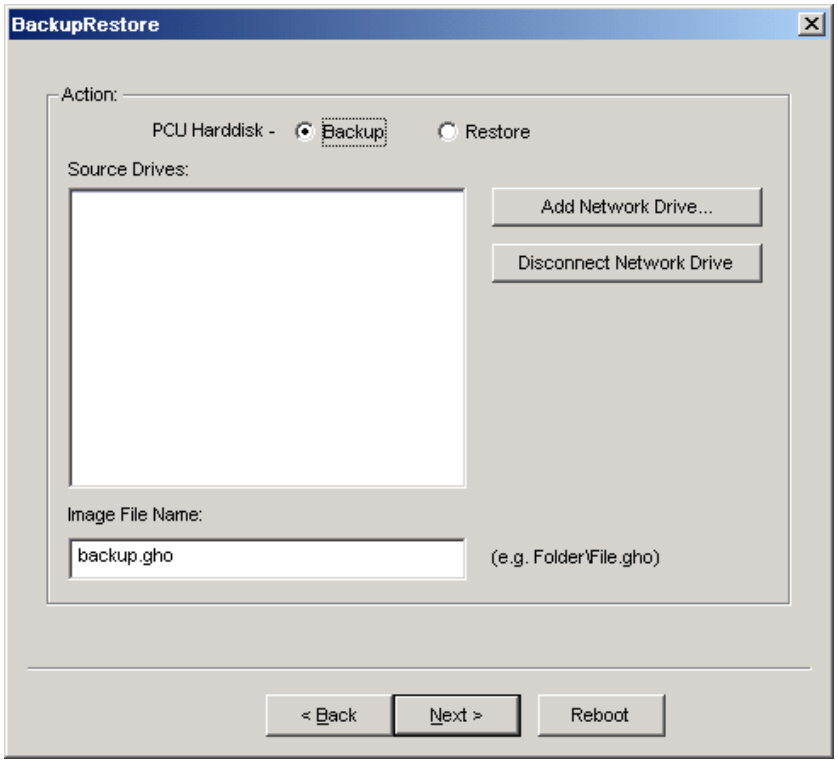


Figure 4-5 Backup hard disk via the network

1. In order to establish a network connection with access to a released drive, select "Add Network Drive" and specify the name of the file for "Image File Name."
2. Under "Share," enter the computer name and the released directory.

3. To receive access rights, enter a user name and password.

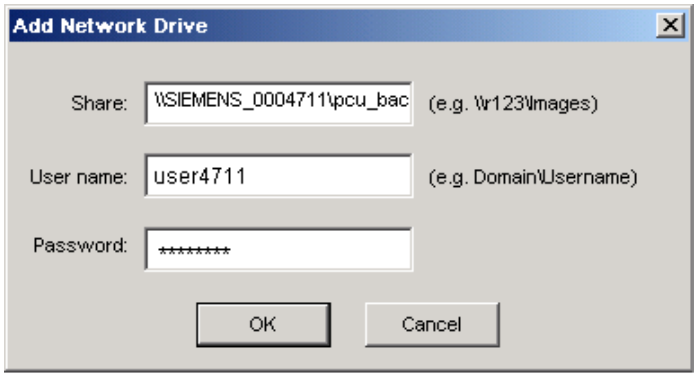


Figure 4-6 Drive Connection

4. Under "Options," select whether the disk image that is to be created is divided into several files of a certain size, so that these files can fit on one CD.

Restoring a hard disk

Select the "Restore" action from "Backup/Restore Disc Image" to restore an image. Click "Next>" to be prompted:

See also

Requirements (Page 81)

4.1.6 Restoring system data from "Emergency Image"

Restoring system data

Select "Restore the Emergency Image", to restore the emergency image. This image must contain the back-up of partition E and can also contain a back-up of partitions C, D or F. It is provided in the event that only the system on partition E: is defective. The user data on partition F: are kept in the current status.

⚠ CAUTION

The reading in of an "Emergency Image" from partition E: can only take place if no additional software has been installed or configured after this back up is created or the registry entries of all the applications that are on partition F: must be included in the image.

Use the "Image Organizer" function only to identify an image as an emergency image that fulfills these conditions.

To restore the system data with "Emergency Image", the PCU must be booted from the service system (EBS).

Manage images

Select “Image Organizer” to mark out one image contained in the displayed list as the emergency image, or to delete an existing image.

See also

How to create a service system for PCU (Page 71)

4.2 Operating the service PC or the PG on the network

Applications

For the following applications, you will, for example, need a connection in the system network between the PCU and a PG/PC:

- To store a backup image from the hard disk of a PCU on a PG/PC.
- To restore a PCU hard disk via the CD-ROM drive of a PG/PC.
- To commission a replacement hard disk.

4.2.1 Requirements

Overview

The following figures show the typical connection options in the system network:

- PCU to "Eth 2" with service PG/PC, directly, using a crossed Ethernet cable
- PCU to "Eth 2" with service PG/PC, via a switch, using an un-crossed Ethernet cable

If you want to connect the service PG/PC via a company network (Eth 1), contact your network service center.

Meaning of the connections:

○	Eth 1 as a DHCP client
●	Eth 2 as a DHCP server
■	Eth 2 with a fixed IP address
Green connection	Uncrossed Ethernet cable
Gray connection	Crossed Ethernet cable (crossover)

Configuration with PG/PC directly to PCU

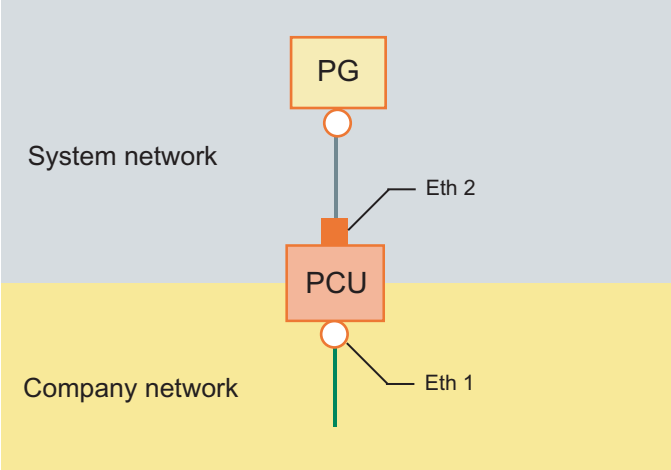


Figure 4-7 Connecting a PG directly to a PCU

Configuration with PG/PC and switch to PCU

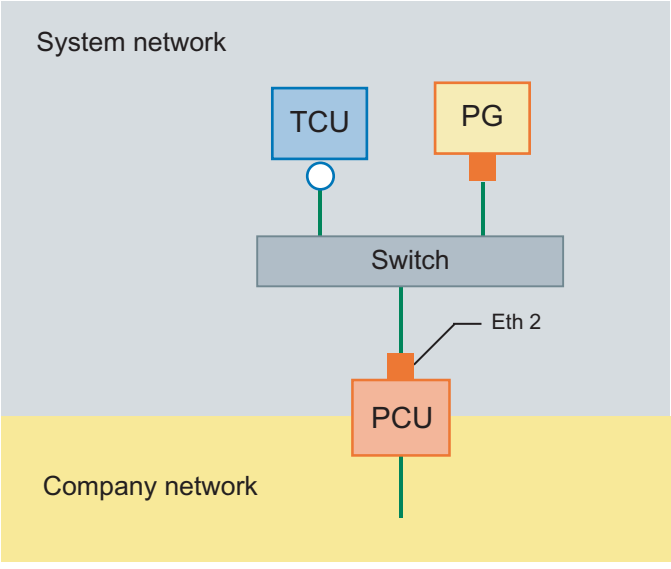


Figure 4-8 Connecting a PG via a switch to a PCU

Note

If a PCU is switched off and on again without its own OP/TP including TCU, and if the PCU boot-up is supposed to take place from the service system (EBS), an external VGA monitor and keyboard are needed in order to operate the PCU.

An external VGA monitor and keyboard are not needed if the TCUs are operating and the PCU is not switched off with the EBS during booting.

Basic procedure

On the PG/PC with Windows XP:

- Connecting a PG/PC to a PCU according to one of the configurations shown above.
- The network protocol used is: TCP/IP.
  TCP/IP is already pre-configured in the basic PCU software.
- Setting up IP addresses on the same subnetwork.
- Releasing a directory on the PG/PC for network access.

On the PCU under WinPE:

- Start the ServiceCenter under WinPE on the PCU.
- Establish a network connection to the released directory of the PG/PC.
- Using the "Backup" function, a ghost image of the PCU hard disk is saved in the released directory of the PG/PC in the event of a need for service.
- With the "Restore" function, the hard disk of the PCU is restored from a ghost image in the released directory of the PG/PC.

See also

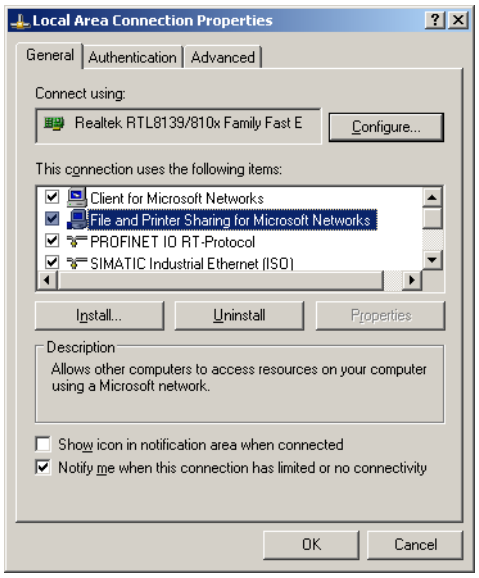
How to backup and restore the hard disk (Page 78)

4.2.2 How to connect a PC/PG to a PCU within the system network

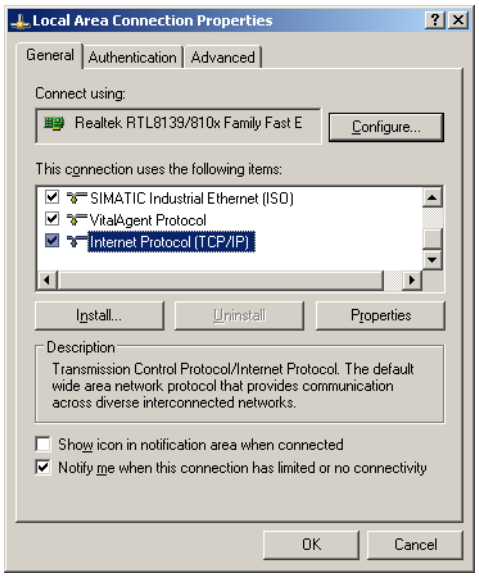
Settings on a PG/PC with Windows XP

On a PG/PC, the following settings must be made:

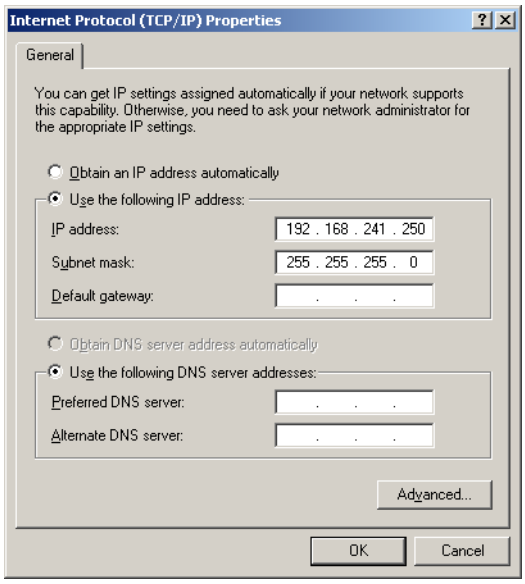
1. Select "Control Panel" → "Network Connections" → "Local Area Connection Properties", then you will see the following dialogue box:



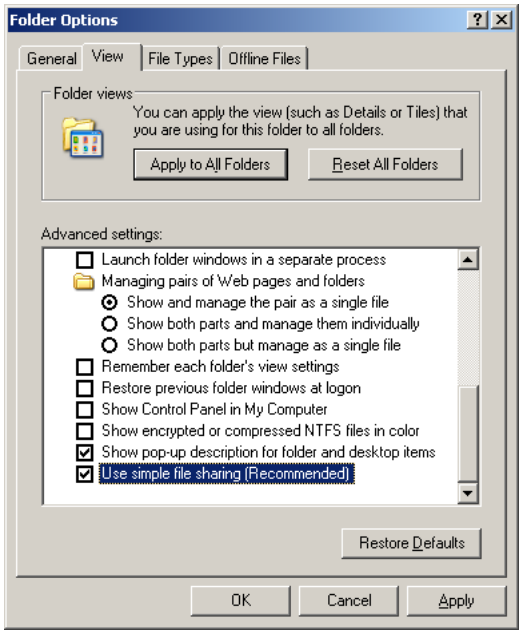
2. Check to see whether "File and Printer Sharing ..." is selected, so that directories can be released and then select "Internet Protocol (TCP/IP)".



3. Open the "Properties" dialogue box and select the option "Use the following IP address", in order to enter an IP address, such as 192.168.214.250 and the subnet screen form 255.255.255.0.

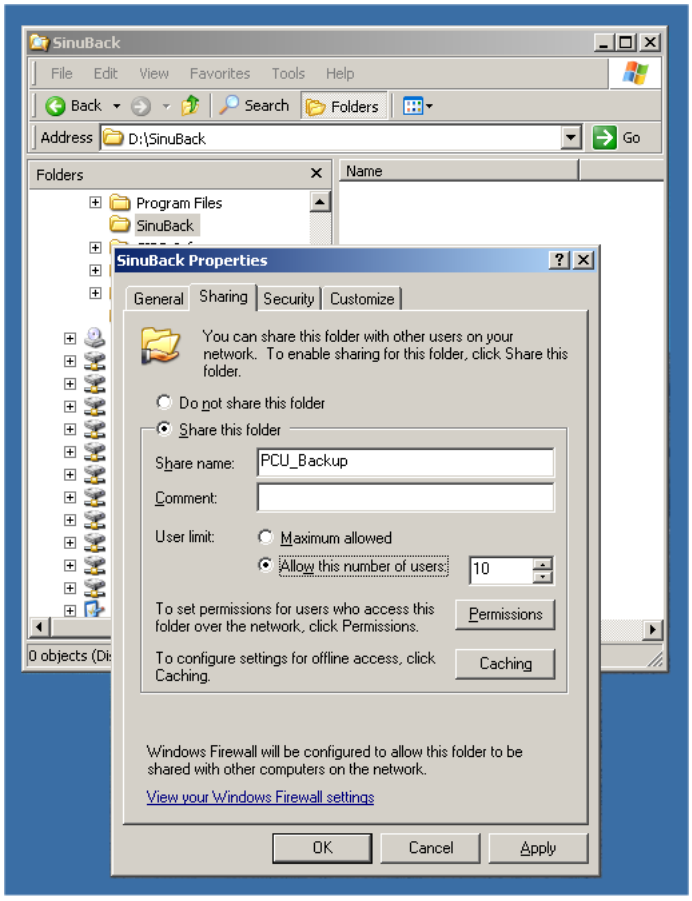


4. Select "Control Panel" → "System" → "Computer Name" tab to view the computer name of the PCU: e.g. SIEMENS-ABC4711
5. Select "Control Panel" → "Folder Options" → "View" and activate "Use simple file sharing (Recommended)", to avoid problems with the release of the directory.



Releasing directory for network access (Windows XP)

1. Create a directory on a local drive; e.g. D:\PCU_Backup
2. Using the right mouse key, open the "Properties" dialogue box of the directory and the "Sharing" tab.



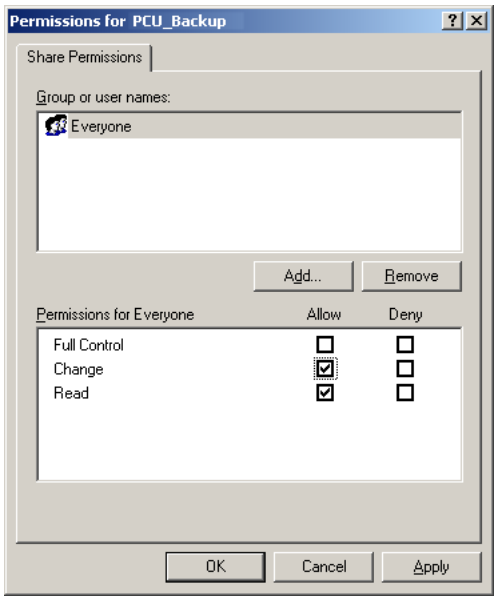
3. Select "Share this folder". As a share name (release name), the directory name is used, e.g. PCU_Backup.

   If the directory name is changed, the new name must be specified when connecting the drive!

Note

Ensure there is sufficient free memory on the hard disk of the PG/PC to be able to save the ghost image when creating a back-up.

4. Select "Permissions" and activate the "Change" square for all the users in the "Allow" column so that files can be saved in this directory (e.g. the ghost image).



Procedure

The following steps must be carried out on the PCU:

1. Start the ServiceCenter with "Start Backup/Restore console".
2. Maintain the pre-setting of the "Network Options" on the PCU:

IP address of PCU:	192.168.214.241	with subnet screen form 255.255.255.0
IP address of PG/PC:	192.168.214.250	with subnet screen form 255.255.255.0

1. In the ServiceCenter, select the service task "Backup/Restore a Disk Image".
2. Establish a network connection to the released directory, e.g. \\SIEMENS-ABC4711\PCU_Backup.
3. Restore the hard disk of the PCU using the ghost image.

Note

If the transfer is interrupted during the "Restore" process, no consistent system is available on the hard disk, i.e. the "Restore" process cannot be repeated because the PCU no longer boots up.

In this event, the "Emergency Boot System" on the USB memory store is used.

See also

How to backup and restore the hard disk (Page 78)

How to create a service system for PCU (Page 71)

4.2.3 How to connect a PC/PG to an NCU within the company network

Add route ... in WINPE

This function is required for the following application: Backing up/restoring ghost images

Example configuration

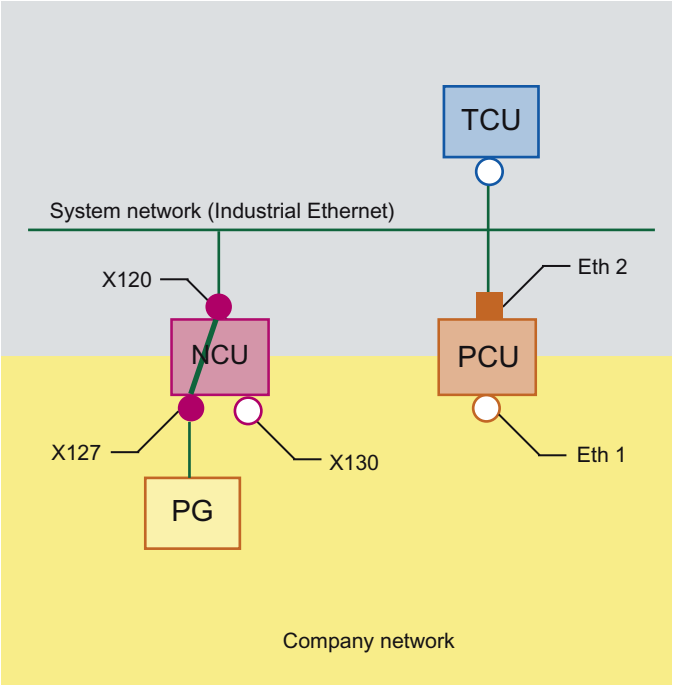


Figure 4-9 Network routing

Conditions

The following conditions must be met in order to use this function:

- The PG must be connected to X127 of an NCU in the system network.
- The NCU and PCU must be connected via the system network.
- You activate routing on the NCU via X127:

  basesys.ini (in the /card/user/system/etc directory),
  parameter EnableSysNetToIBNForwarding=1

  OR

  System Network Center, "System Basics" tab,
  parameter IBN network (X127) settings: "Forwarding from system network" **enable**
- Enable a directory on the PC/PG.
- The user who logs on must be one of the recognized Windows users on the PC/PG; for example, auduser is **not** recognized on a PC.

Procedure

Activate routing prior to establishing the network connection:

1. Press the "Add Route ..." button.

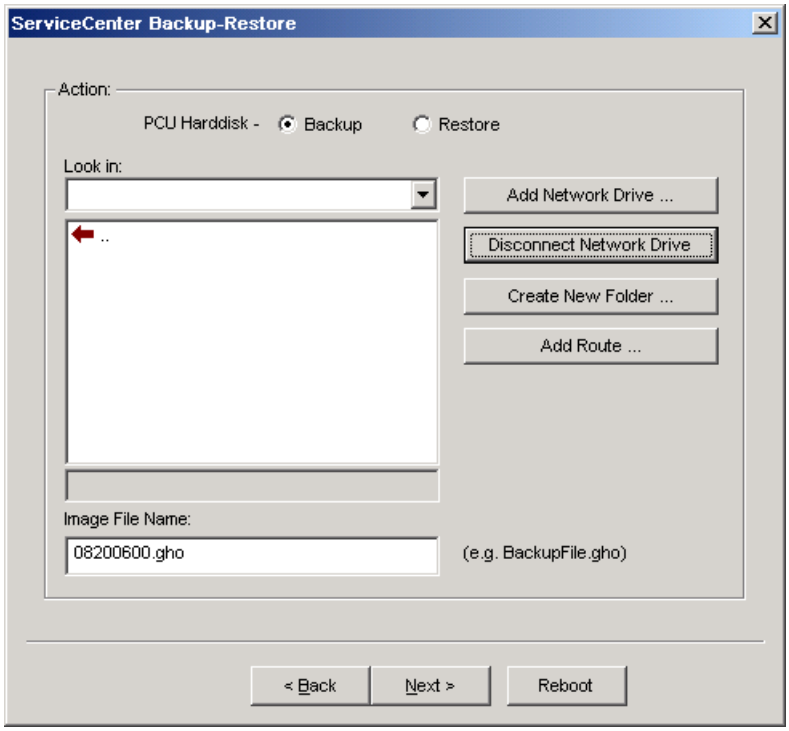


Figure 4-10 ServiceCenter Backup-Restore

2. Establish the network connection using "Add Network Drive ...".

   In the example: \\192.168.215.2\<sharename>

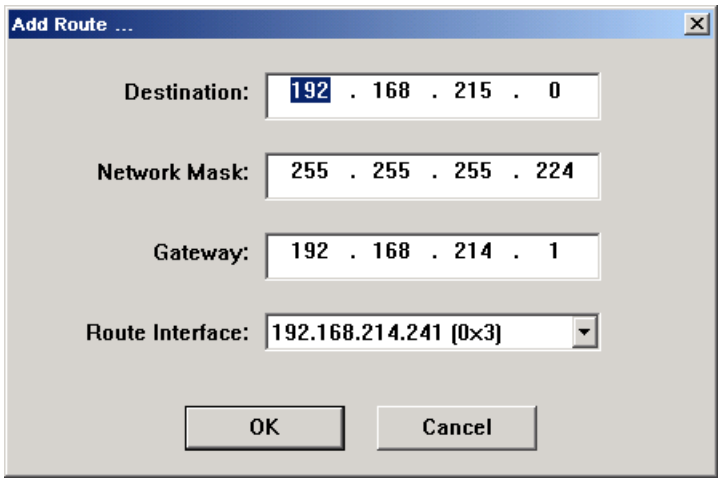


Figure 4-11 Dialog: Add Route ...

3. Logon and password details for a local user on the PG:

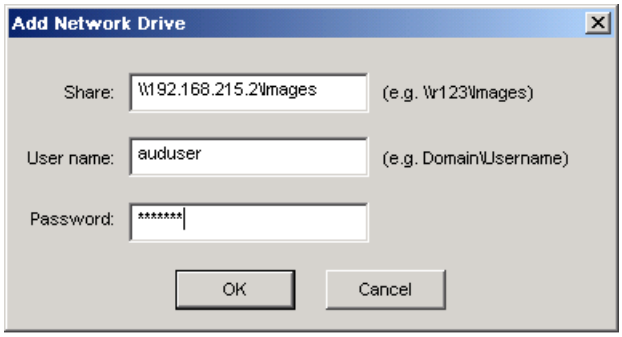


Figure 4-12 ServiceCenter: Add Network Drive

4. Define the computer name as an IP address; you cannot give it your own name.

   Share access to a directory or to the CD or DVD drive on the PG/PC must have been enabled.

4.3 Commissioning a replacement hard disk

Overview

The replacement hard disk is supplied with an installed "Emergency Boot System".

The mechanical and electrical steps involved in replacing the PCU hard disk are described in:

References: /BHsl/ Operator Components and Networking Manual

Commissioning a replacement hard disk

After installing the replacement hard disk, the Ethernet interfaces of the PCU are preset in the following manner:

- Ethernet 1 (Company Network) as a standard DHCP client
- Ethernet 2 (System Network) as a SINUMERIK DHCP server with the fixed IP address 192.168.214.241 and subnet screen 255.255.255.0

The PCU must therefore be disconnected from the system network before the replacement hard disk is fitted.

Download a hard disk back-up (disk image) to commission the replacement hard disk. Please proceed as follows:

1. Connect a PG/PC as per the recommended configurations.
2. Start the ServiceCenter and select "Restore Disk Image".

Note

If the transfer is interrupted during the "Restore" process, no consistent system is available on the hard disk, i.e. the "Restore" process cannot be repeated because the PCU no longer boots up.

In this event, the "Emergency Boot System" is used.

See also

Requirements (Page 81)

How to backup and restore the hard disk (Page 78)

How to create a service system for PCU (Page 71)

Service and diagnostics

5

5.1 PCU Hardware Diagnostics

Intended use

The PCU hardware supports the diagnostics of important system components via an integrated "safecard", which is designated as a Safecard-On-Motherboard (SOM).

These diagnostic functions are only evaluated by systems with HMI Advanced. The fault statuses of the hardware are reported in the form of alarms via the operator interface of HMI Advanced. This allows for visualization of the data in HMI Advanced and external evaluation.

Monitored Parameters

The following physical parameters of the PCU hardware are monitored:

- CPU temperature
- Housing temperature
- I/O chip temperature
- Speed of the two housing fans
- S.M.A.R.T - status of the hard disk

Logging faults

The PCU hardware monitor logs all hardware faults in the Windows event log so that the faults can be output even without installing an HMI application.

The alarms are output in the log under "Control Panel" → "Administrative Tools" → "Event Viewer".

See also

- Commissioning a replacement hard disk (Page 91)
- Operator Components and Networking Manual: Chapter, spare parts
- Description of the alarms: SINUMERIK 840D sl Diagnostics Manual

5.2 Evaluation of the 7-segment display

Intended use

The 7-segment display is intended for PCU diagnostics in operation without a local OP (known as "Headless mode"). If an error is detected during booting, a local display is needed for subsequent error analysis of the connection.

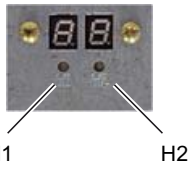


Figure 5-1 7-segment display with LEDs

The two displays have the following function:

- Segment display H1

  Segment display H1 and the associated LED are assigned to the PCU basic software. Status codes are output during system booting, normal operations and shutdown. Compatibility in relation to the NCU modules is taken into account.

- Segment display H2

  Segment display H2 and the associated LED are assigned to the application software.

Meaning of status codes

- During system power-up:

LED H1	LED H2	7-segment display		Status	
Orange	Orange	Output of BIOS post codes		After switching on the system	
Orange	Off			After cycling the BIOS	
Orange	Off			After starting Windows	
		1	0	Start Windows	Load device drivers needed for the Windows start
		2	0	PCU hardware service	The PCU hardware service has been started.
		5	0	Network	Wait for network interfaces to be ready.
		8	0	TCU support test step 1	Wait for FTP server to start
		9	0	TCU support test step 2	Wait for boot server to start for TCU network boot and for TCU hardware service to start
		A	0	TCU support test step 3	Wait for VNC server to start

LED H1	LED H2	7-segment display		Status	
		B	0	HMI manager	Wait for HMI manager to start
		E	0	PCU base software	General fault: see Windows "Event Viewer"

- During operation:

LED H1	LED H2	7-segment display		Status	
Flashing green	--	0	0	OK	
Flashing red	--			Error:	
		1	0	Temperature alarm	Housing or CPU temperature; temperature above limit value (SOM error)
		2	0	Fan alarm	Housing or CPU: Low fan speed or fan failure (SOM error)
		3	0	Hard disk alarm	S.M.A.R.T hard disk error
		6	0		Failure of VNC server or VNC server service stopped

- During shutdown

LED H1	LED H2	7-segment display		Status
Flashing red/green	--	5	0	Shutdown active

5.3 Setting of the service switch (PCU 50.5 only)

Intended use

The "PCU Hardware Service" component as part of the PCU Base software provides a function to read-out the switch positions.

Figure 5-2 Rotary coding switch (hexadecimal)

Meaning of switch positions

Only the settings of the service switch that are relevant for the commissioning engineer are listed:

Switch setting	Mode of operation	Function
0	---	Normal operation (default setting)
6	Users	Reserved for additional software
9	Service	Headless operation without OP/TP
A	Service	Firmware recovery
C	Service	Checking
D	Service	Diagnostics
E	Service	Booting from the emergency boot system

5.4 Enabling/disabling error log during boot up

Application

Each time the system is booted up, information is written to a block in the file D:\$$Base.log, which contains the date, time and nature of administrative interventions.

Information about the booting controlled by the HMI Manager, can be displayed on the screen and written to log file D:\$$Base.log.

Output in log file

The output is controlled by registry values:

- **Type of information**

  The type of information to be output is set via registry value "HKLM\SOFTWARE\Siemens\SINUMERIK\Basic software\<version>\HMI Manager\InfoLevel":

  InfoLevel (DWORD)

  = 1: Mandatory information is output (default setting)

  = 2: Mandatory and supplementary information is output

  = 3: Mandatory, supplementary and trace information is output
  (InfoLevel <= 0 is treated as InfoLevel == 1;
  InfoLevel <= 3 is treated as InfoLevel == 3)

- **Outputting information to the screen**

  Whether the information is also to be displayed on the screen (as well as being output to the log file) is set via registry value 'HKLM\SOFTWARE\Siemens\SINUMERIK\Basic software\<version>\HMI Manager\ShowInfo':

  ShowInfo (DWORD)

  = 0: Displays the mandatory information,
  no display of the supplemental and trace information

  = 1: Mandatory, supplementary and trace information is displayed (default)

5.5 How to search for stations within the system network

Intended use

The VNC scanner is used within the system network. The scanner is primarily used to identify devices containing an active VNC server, e.g. NCU or PCU.

The VNC scanner offers the option of connecting directly to the VNC server and, for example, operating an HMI application. The integrated VNC viewer is used to do this.

Furthermore, it enables you to call up a list of all the network devices, thereby creating an overview of the system network.

Note

The VNC scanner is available on the Service Desktop of the PCU and on the PCU base software DVD for installation on a PG/PC.

You require a mouse to use this program.

Operating "VNC scanner"

1. You can launch the "VNC Scanner" program via this link on the Service Desktop of the PCU .

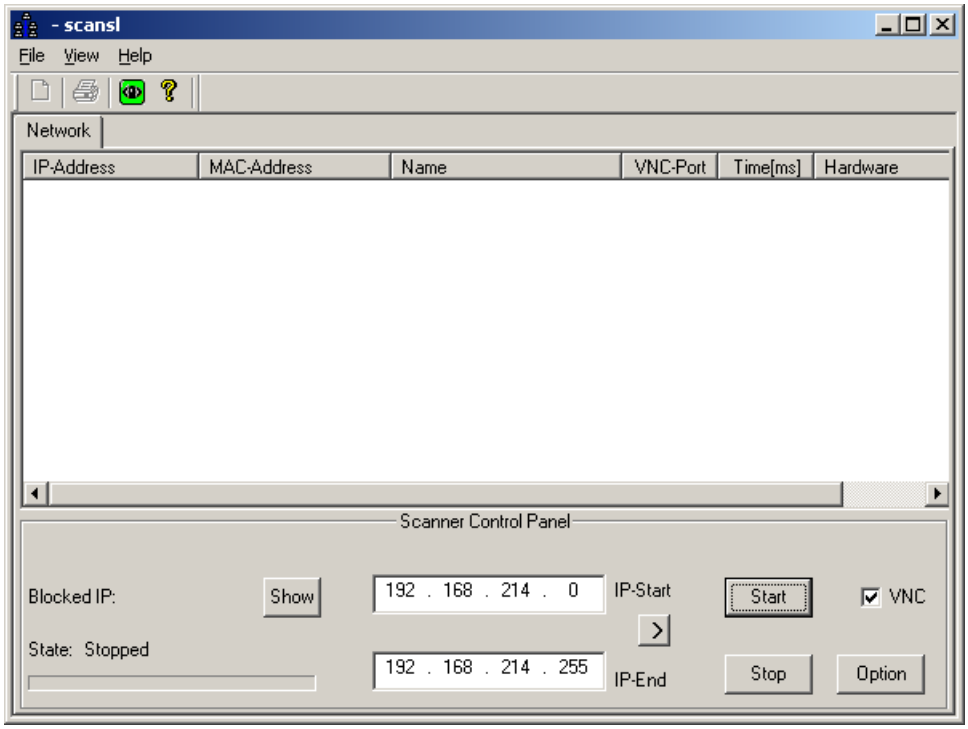


Figure 5-3 VNC scanner

2. "IP start / IP end": Set the IP-address browsing range.

   Eight ranges can be saved. Click on button " **>**" to switch to the next range.

3. "VNC" option:
   - ON: only search for VNC servers.
   - OFF: search all the stations in the network.
4. Start the search with the "Start" button.

   The following station parameters will be listed:
   - IP address
   - MAC address
   - Name in the network
   - VNC port
   - Response time of the station in milliseconds
   - Device type

Note

local device #

When the devices are listed, an IP address will be identified with "#" to indicate that this is the local device on which the VNC scanner will be used.

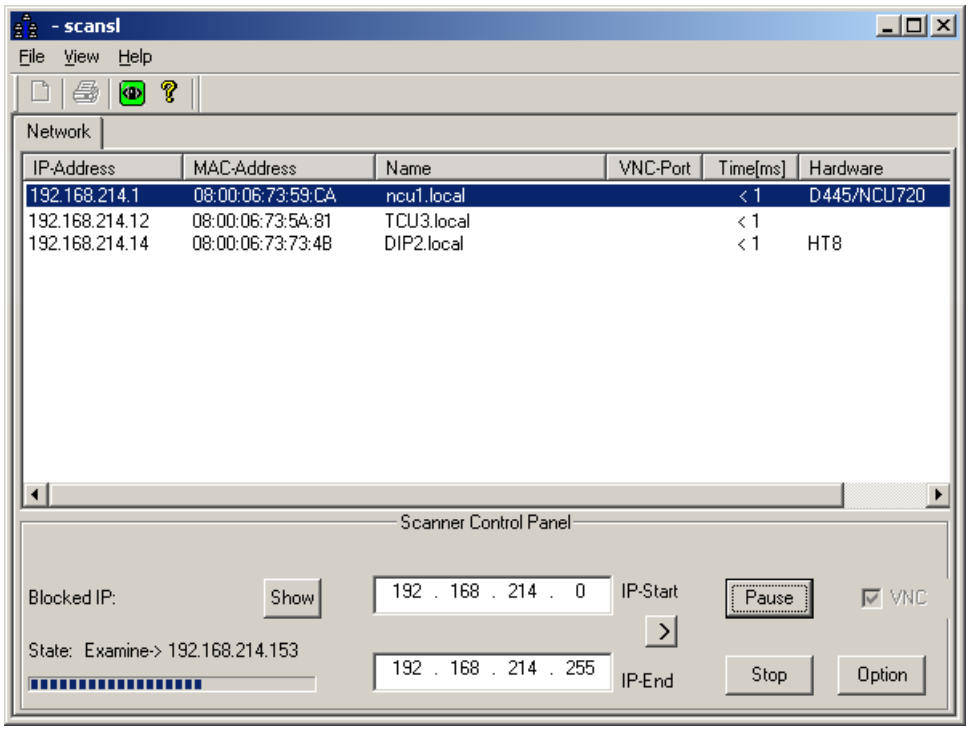


Figure 5-4 VNC scanner: List of stations

5. By right-clicking a network station from the list, you can execute the following actions via a pop-up menu:
   - "VNC": Connecting directly to the VNC server and, if applicable, operating the HMI.
   - "VNC → Auto reconnect": Corresponds to the option "Automatic reconnect if the server closes the connection" in order to restore the connection to the selected network station.
   - Ping: Opens a command shell and executes the "ping" command to the selected network station.

Note

Operation via a VNC viewer:

A system can only be monitored from another station via an external VNC viewer (default).

To view the system from another station, this function must be enabled by the system. You can find the settings for this in the "System Network Center" or directly in tcu.ini in the [VNCViewer] section.

Should you wish to access a PCU via the company network using the VNC scanner or VNC viewer, port 5900 must be added to the PCU under "Control Panel" → "Windows Firewall" → "Exceptions".

Reference: Operator Components and Networking Manual

Additional Options

1. Use this button to start the VNC viewer.
2. Use the "Option" button to set parameters for the search.

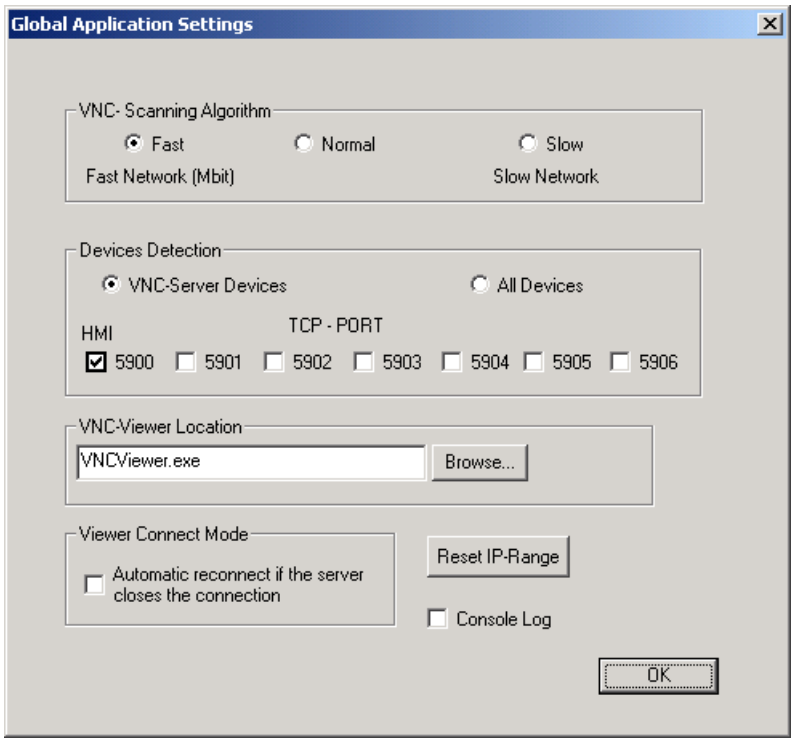


Figure 5-5 VNC scanner: Set search parameters

- VNC scanning algorithm:

  Default is "Fast", i.e. device feedback within approximately 100 ms
- Devices detection: (corresponds to the "VNC" option, see point 3).
  - "VNC server devices": only search for VNC servers.
  - "All devices": search all the stations in the network.
- VNC viewer location:

  Link to the VNC viewer (open source program: already pre-installed on the PCU; on a ServicePC this link must be specified).
- Viewer default connection mode:

  "Automatic reconnect if the server closes the connection" (default: OFF)
  - OFF: One attempt is made to establish a connection.
  - ON (loop mode): For situations where access will be via Internet, for example for service purposes, then the system will wait longer and try again after several milliseconds to establish a connection to this station.
- "Reset IP range": All IP address ranges are reset.
- Console log: Opening a console to output a protocol, e.g. for error analysis (default: OFF).

Options for the VNC viewer

CAUTION
Do not change defaults! To ensure that the VNC viewer works properly, the following options may not be changed.

After starting the VNC viewer, the following dialog opens:

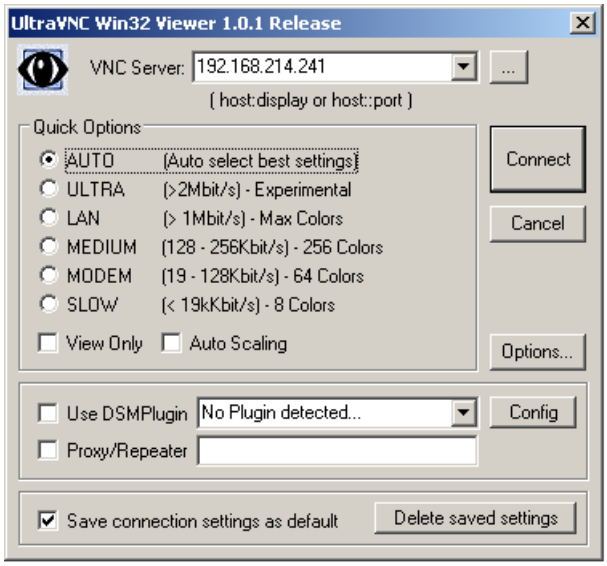


Figure 5-6 Default: UltraVNC

After clicking the "Options ..." button, the following dialog opens:

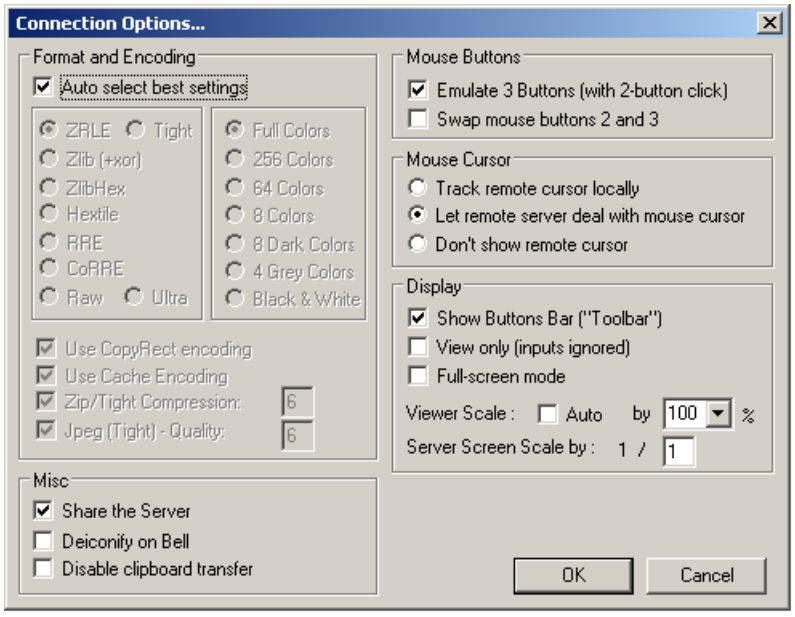


Figure 5-7 Default: Connection Options ...

List of Abbreviations

A

A.1 Abbreviations

CF	CompactFlash card: Memory card
CFS	Cluster File System
DCK	Direct Control Keys: Direct control keys
DCP	Discovery and Basic Configuration Protocol
DHCP	Dynamic Host Configuration Protocol: Dynamic assignment of an IP address and other configuration parameters on a computer in a network
DNS	Domain Name System: Conversion of domain names into IP addresses
EBS	Emergency Boot System
EKS	Electronic Key System: System to check the identity of a user (authentication system)
EUNA	End User Notification Administration
HMI	Human Machine Interface: Operator interface
IRT	Isochronous Realtime (Ethernet)
LLDP	Link Layer Discovery Protocol: multi-vendor Layer 2 Protocol defined in accordance with the IEEE-802.1AB standard, allows information to be exchanged between devices.
MAC	Media Access Control: The MAC address is a 48-bit Ethernet ID.
MCP	Machine Control Panel: Machine control panel
MPI	Multi-Point Interface: Multiple interface
MUI	Multilanguage User Interface
NCK	Numerical Control Kernel: NC kernel with block preparation, travel range, etc.
NCU	Numerical Control Unit: NCK hardware unit
NRT	Non-Realtime (Ethernet)
NTFS	New Technology File System
NTP	Network Time Protocol: Standard for synchronizing clocks in the entire network
NTPD	NTP Daemon: Utility that runs in the background and does not have to be started by the user.
PCU	PC Unit: Computer unit
PDEV	Physical device
PG	Programming device
PLC	Programmable Logic Control: Programmable logic controller
RAM	Random Access Memory: Program memory which can be read and written into
RDY	Ready: The system is ready to operate.
SNMP	Simple Network Management Protocol (network protocol for monitoring and controlling network elements such as routers, servers, switches, and printers from a central station).
SSD	Solid State Drive
TCU	Thin Client Unit
TFTP	Trivial File Transfer Protocol: Very simple data transmission protocol
UDP	User Datagram Protocol: NTP is mostly processed via UDP.

USB	Universal Serial Bus
UPS	Uninterruptible power supply
UTC	Universal Time, Coordinated: Coordinated universal time
VNC	Virtual Network Computing

Index

U

V

W

Appendix

A

A.1 Overview