Description of Functions 02/2005 Edition

sinumerik

SINUMERIK 840D/840Di/810D
ShopMill

SIEMENS

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SINUMERIK 840D/840Di/810D

ShopMill

Description of Functions

Valid for

Control	*Software version*
SINUMERIK 840D powerline	7
SINUMERIK 840DE powerline	7
SINUMERIK 840Di	3
SINUMERIK 840DiE (export version)	3
SINUMERIK 810D powerline	7
SINUMERIK 810DE powerline	7

02/05 Edition

SINUMERIK® Documentation

Printing history

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

The status of each edition is shown by the code in the “Remarks” column.

Status code in the “Remarks” column:

A . . . . . New documentation.
B . . . . . Unrevised reprint with new Order No.
C . . . . . Revised edition with new status.

Edition	Order No.	Remarks
10/97	6FC5 297-2AD80-0BP0	**A**
11/98	6FC5 297-2AD80-0BP1	**C**
03/99	6FC5 297-5AD80-0BP0	**C**
08/00	6FC5 297-5AD80-0BP1	**C**
12/01	6FC5 297-6AD80-0BP0	**C**
08/03	6FC5 297-6AD80-0BP1	**C**
11/03	6FC5 297-6AD80-0BP2	**C**
02/05	6FC5 297-6AD80-0BP3	**C**

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

Additional information can be found at:
http://www.siemens.com/motioncontrol

We have checked that the contents of this document correspond to the hardware and software described. Nevertheless, differences might exist and therefore we cannot guarantee that they are completely identical. The information given in this publication is reviewed at regular intervals and any corrections that might be necessary are made in the subsequent printings. Suggestions for improvement are also welcome.

This publication was produced with Interleaf V 7

Subject to change without prior notice.

Order No. 6FC5 297-6AD80-0BP3
Printed in Germany

Siemens Aktiengesellschaft

Preface

Structure of the documentation

The SINUMERIK documentation is subdivided into 3 parts:

- General documentation
- User documentation
- Manufacturer/Service documentation

Audience

This documentation is intended for use by manufacturers of vertical machining centers or universal milling machines controlled by the SINUMERIK 840D/ 840Di/810D system.

Objective

This Description of Functions provides the information you require to configure and start up the ShopMill system.

Note

This Description of Functions is valid for ShopMill SW 6.4.

Hotline

If you have any questions, please contact the following hotline:
A&D Technical Support Phone: +49 (0) 180 5050–222
Fax: +49 (0) 180 5050–223
Email: adsupport@siemens.com
www.siemens.com/automation/support-request

If you have any queries (suggestions, corrections) in relation to this documentation, please fax or e-mail us:
Fax: +49 (0) 9131 98–2176
You will find a fax form on the response sheet at the end of the document
E-mail: motioncontrol.docu@siemens.com

Internet address

http://www.siemens.com/motioncontrol

SINUMERIK 840D powerline

Improved-performance variants SINUMERIK 840D powerline and SINUMERIK 840DE powerline have been available since 09/2001. The hardware description below contains a list of the available powerline modules:
References: /PHD/, Configuring Manual SINUMERIK 840D

SINUMERIK 810D powerline

Improved-performance variants SINUMERIK 810D powerline and SINUMERIK 810DE powerline have been available since 12/2001. The hardware description below contains a list of the available powerline modules:
References: /PHC/ SINUMERIK 810D Configuration Manual

Standard scope

This document provides information about the control system design and the interfaces of the individual components. It also describes the start-up and installation procedure for ShopMill with SINUMERIK 840D/840Di/810D.

For detailed information about individual functions, function assignment and performance data of individual components, please refer to the approporiate document for the subject concerned (e.g. manuals, description of functions etc.).

User-oriented activities such as the creation of parts programs and control operating procedures are described in details in separate documents.

Further descriptions of tasks to be performed by the machine tool manuacturer are also available for the standard SINUMERIK 840D/840Di/810D. We may refer to them in this documentation if appropriate.

Finding information

In addition to the table of contents, we have provided the following information in the appendix for your assistance:

1. Abbreviations
2. List of References
3. Index

For a complete list and description of the ShopMill alarms, please refer to

References: /BAS/, ShopMill Operation/Programming

The SINUMERIK 840D/840Di/810D alarms are also listed in

References: /DA/, Diagnostics Guide

For further useful information on start-up and troubleshooting, please refer to

References: /FB/, D1, “Diagnostics Tools”

Notes

The following symbols with special significance are used in the documentation:

Note

This symbol always appears in this documentation where further, explanatory information is provided.

Warnings

The following warnings with varying levels of severity are used in this document:

Danger

Indicates an imminently hazardous situation which, if not avoided, **will** result in death or serious injury or in substantial property damage.

Warning

Indicates a potentially hazardous situation which, if not avoided, **could** result in death or serious injury or in substantial property damage.

Caution

Used with the safety alert symbol indicates a potentially hazardous situation which, if not avoided, **may** result in minor or moderate injury or in property damage.

Caution

Used without safety alert symbol indicates a potentially hazardous situation which, if not avoided, **may** result in property damage.

Notice

Used without the safety alert symbol indicates a potential situation which, if not avoided, **may** result in an undesirable result or state.

Unit of measurement

In this manual, the units of the parameters are always indicated as metric values. The equivalent imperial units are shown in the table below.

Metric	Inch
mm	in
mm/tooth	in/tooth
mm/min	in/min
mm/rev	in/rev
m/min	ft/min

Notes

Contents

Notes

Hardware

1

System configuration

The hardware configuration for ShopMill is as standard for SINUMERIK 810D/840D/840Di.

References:

/PHC/, SINUMERIK 810D, Configuration Manual
/IAC/, SINUMERIK 810D, Installation and Start-Up Guide
/PHD/, SINUMERIK 840D, Configuration Manual NCU 561.2-573.3
/IAD/, SINUMERIK 840D/SIMODRIVE 611D, Installation and Start-Up Guide
/HBI/, SINUMERIK 840Di, Manual

Table 1-1 Basic components

Basic components	Order No.	Remarks
CCU3 (810D)	6FC5410-0AY03-0AA1	
NCU571.4 (840D)	6FC5357-0BB12-0AE0	
NCU572.4 (840D)	6FC5357-0BB23-0AE0	
NCU573.4 (840D)	6FC5357-0BB34-0AE0	
NCU573.5 (840D)	6FC5357-0BB35-0AE0	
PCU 50 + MCI2 board (840Di)	6FC5220-0AA21-2AA0	566 MHz, 256 MB, Windows XP
PCU 50 + MCI2 board (840Di)	6FC5220-0AA22-2AA0	1.2 GHz, 256 MB, Windows XP

Table 1-2 Operator components

Operator control components	Order No.	Remarks
OP010 operator panel	6FC5203-0AF00-0AA0	
OP010C operator panel	6FC5203-0AF01-0AA0	
OP010S operator panel	6FC5203-0AF04-0AA0	
OP012 operator panel	6FC5203-0AF02-0AA0	
OP015 operator panel	6FC5203-0AF03-0AA0	
PCU 20 with system software	6FC5210-0DF00-0AA1	166 MHz, 32 MB
PCU 20 with system software	6FC5210-0DF00-1AA1	233 MHz, 32 MB
PCU 50	6FC5210-0DF21-2AA0	566 MHz, 256 MB, Windows XP
PCU 50	6FC5210-0DF22-2AA0	1.2 GHz, 256 MB, Windows XP
MCP 483C	6FC5203-0AF22-0AA0	Standard/US layout
Key cap for MCP	6FC5248-0AF12-0AA0 6FC5248-0AF21-0AA0	Colored Clear

Table 1-2 Operator components

Full CNC keyboard OP 032S	6FC5203-0AC00-1AA0	Standard/US layout
Machine control panel OP 032S	6FC5203-0AD10-1AA0	Standard/US layout
Key cover for OP 032S full CNC keyboard and OP 032S machine control panel	6FC5248-0AA02-0AA0	Standard/US layout
Mini handheld unit	6FX2007-1AD01	

■

Supplementary Conditions

2

Please observe the following supplementary conditions when using ShopMill:

- ShopMill is only executed in channel 1, mode group 1.
- The standard MPI bus addresses for the PCU 20, PCU 50, NC and PLC must not be changed.
- Up to 5 axes plus a spindle are displayed on the ShopMill operator interface.
- The machine axes are assigned to fixed numbers (1=X, 2=Y, 3=Z).
- The spindle can be assigned to axis numbers 4, 5 or 6.
- ShopMill permits geometry axis exchange under the following conditions.
  There must always be three geometry axes.
  The names of the channel axes (MD 20080) and the geometry axes (MD 20060) must be different.
  Exchange of geometry axes can only be programmed for linear axes.
  Exchange of geometry axes is no possible for spindles.
  Only special axes known to ShopMill can be exchanged with geometry axes.
- ShopMill only runs with tool management.
  The change point must always be spindle 1 (see configuration file). The load point can be 1 or 2 (see MD 9673 $MM_CMM_TOOL_LOAD_STATION).
- With ShopMill Open you are not allowed to change the position of the following softkeys. This means that a specific task must always be assigned to these functions in the REGIE.INI file.
  Task 0 (horizontal softkey 1): Machine operating area
  Task 1 (horizontal softkey 2): Program Manager operating area
  Task 2 (horizontal softkey 3): Program operating area
  Task 4 (horizontal softkey 5): Tools/Zero Offsets operating area
- You can use only one operator panel with ShopMill.
- Handheld programming unit (HHU) in addition to ShopMill on PCU50 on request only.

- It is not possible to use the HMI and the Windows screensaver at the same time.
  References: /IAM/, IM2 Startup HMI Embedded
  IM4 Startup HMI Advanced

Reserved Functions

3

The following functions are utilized by ShopMill and must not be assigned for other purposes.

Extended M functions

M functions with extended address:
M[value]=100
M[value]=101

M100 and M101 are defaults and must be changed where required.

1. Extended M address:
DB82.DBB12 ext_m_cmd_1, standard value=100
Display MD 9684 CMM_M_CODE_TOOL_BITS_1, standard value=100

2. Extended M address:
DB82.DBB13 ext_m_cmd_2, standard value=101
Display MD 9685 CMM_M_CODE_TOOL_BITS_2, standard value=101

PROG_EVENT

The system cycle PROG_EVENT.SPF is used by the standard cycles and by ShopMill.
If you want to use the cycle PROG_EVENT.SPF for user functions too, it is necessary to implement these user functions in the cycle CYCPE_US.SPF. Store cycle CYCPE_US.SPF in the user cycles or manufacturer cycles directory.

■

Notes

Start-Up

4

4.1 Preconditions

Data transfer

For data transfer, you require:

- Hardware
  - Programming device, e.g. a PG 740 or a PC with MPI module
  - Cable for RS-232 PG/PC-NC (Order No.: 6FX2 002-1AA01-0BF0)
  - Cable for MPI bus (Order No.: 6ES7 901-0BF00-0AA0)
  - PCMCIA card
    This PCMCIA card can be used for the NCU/CCU or for the PCU 20.
    The PCMIA card is referred to by the following terms for easier distinction in the start-up sections:
    - for the NCU/CCU “NC card”
    - for the PCU “PC card”
- Software
  - SIMATIC Step 7, SW 4 and later (see SIMATIC catalog for order number)
  - PCIN (See NC Z catalog for order number)
  - SINUCOPY-FFS for NC card

ShopMill software package

The ShopMill software package to be installed comprises the following:

- ShopMill for PCU 20
- ShopMill for PCU 50
- Toolbox
- PLC Toolbox

The floppy disks are available on the ShopMill CD-ROM. The files must be copied to the hard disk of a PC/PG. The procedure for further installation of the software on PCU and NC/PC is described in the following sections on installation and start-up.

The ShopMill CD-ROM also includes the NC standard software releases for SINUMERIK 810D/840D. These can be loaded onto a PCMIA card via SINUCOPY-FFS.

Note

The contents of the ShopMill CD ROM are listed in the file UPDATE_D.RTF (German) and UPDATE_E.RTF (English).
A compatibility list is provided in file COMPAT.XLS.

ShopMill for PCU 20

The CD contains directories with software that generates a 16-MB flash image for upgrading a PCU 20 / 16 MB. The software is provided in 6 languages (German, English, French, Italian, Spanish and Chinese).

The “Installation-disk” directory contains a “SETUP.EXE”. This starts the program with which you can create a flash image and modify the following parameters of the application:

- Select further languages,
- Change the MPI parameters (NETNAMES.INI),
- Adapt parameters for several operator panel fronts / NCUs,
- Set defaults for display machine data,
- Adapt and expand alarm text files,
- Transfer user-defined screens for PLC status,
- Add additional user screens.

ShopMill for PCU 50

The diskettes contain the software in 6 languages (German, English, French, Italian, Spanish, and Chinese).

Toolbox

The Toolbox contains the following ShopMill data:

- ShopMill machine data sets
- Cycles, definitions (macros, GUD) and examples
- Configuration files for the tool management function

PLC Toolbox

The PLC Toolbox contains:

- ShopMill PLC program for 8x0D
- SINUMERIK add-on for STEP 7
- NCVar selector

In addition to the ShopMill PLC blocks, the ShopMill PLC program contains the blocks for the basic PLC program.
Installation is menu-guided via an install shield.

Note

Please read the information in file SIEMENSD.WRI (German) or SIEMENSE.WRI (English) for the PLC toolbox.

4.2 Initial start-up

4.2.1 Sequence

Before you begin with start-up please read about the supplementary conditions and reserved functions.

Proceed as follows for installation and start-up:

1. Installation of ShopMill on PCU
2. NC start-up
3. PLC installation and start-up
4. Adapt display machine data
5. Install additional functions (optional)
6. Customize the operator interface (optional)
7. Run a test using the acceptance certificate

You can perform tool management start-up either together with NC and PLC start-up or afterwards. If tool management has already been installed on the machine you only have to adapt the display machine data for the tool management (see Section 8.2 “Start-up sequence”).

4.2.2 Installing ShopMill on PCU 20

When you install ShopMill on the PCU 20 the HMI Embedded software is automatically installed with it, that means, you do not have to install the HMI Embedded software on the PCU 20 separately.

ShopMill is installed on the PCU 20 by means of PC card. PC/PG with Windows NT/2000/XP is required.
To store the data on the installation CD and create a flash image for the PC card, at least 30 to 40 MB of free memory must be available on the PC or PG. (And much more memory is required for logographic languages such as Chinese etc.!)

Software replacement

Proceed as follows to replace the software:

1. software replacement with standard configuration
   or
   Software replacement with changed configuration
2. Generate image
3. Transfer image to PC card
4. Import image from PC card to PCU:
   – import complete new flash image
   – replace all files except for the configuration data
   – keep all all user files within one software version

Note

ShopMill uses the alarm texts and PLC messages of the CNC ISO operator interface. For more detailed information please refer to:
References: /IAM/, Installation and Start-up Guide HMI 840D/840Di/810D

Installation via PC card

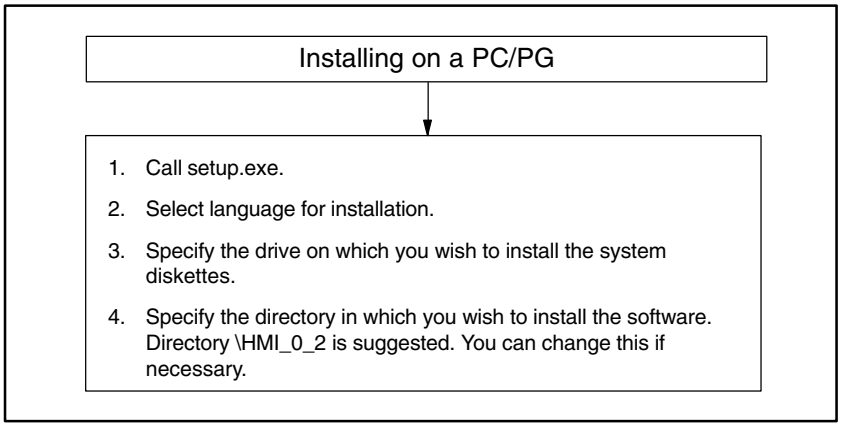


Fig. 4-1 Installing on a PC/PG

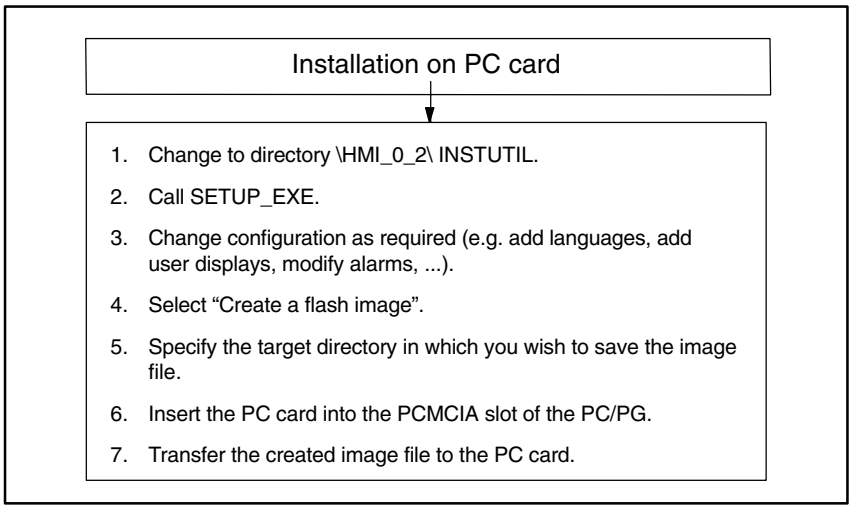


Fig. 4-2 Creating a PC card

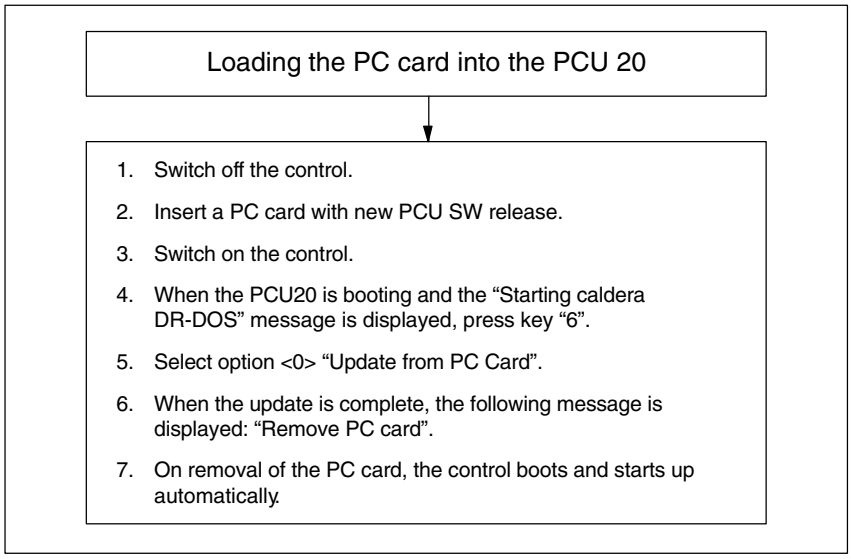


Fig. 4-3 Loading the PC card into the PCU 20

4.2.3 Installing ShopMill on PCU 50

The HMI Advanced software must be installed on the PCU 50 before you install ShopMill. (HMI Advanced is an option with SINUMERIK 840Di.)

Note

ShopMill uses the alarm texts and PLC messages of the CNC ISO operator interface. For more detailed information please refer to:
References: /IAM/, Installation and Start-up Guide HMI 840D/840Di/810D

You can install ShopMill on the PCU 50 in one of three different ways:

- Installation via parallel interface (FAT 32)
- Installation via floppy drive
- Installation via a network link

Installation via parallel interface (FAT 32)

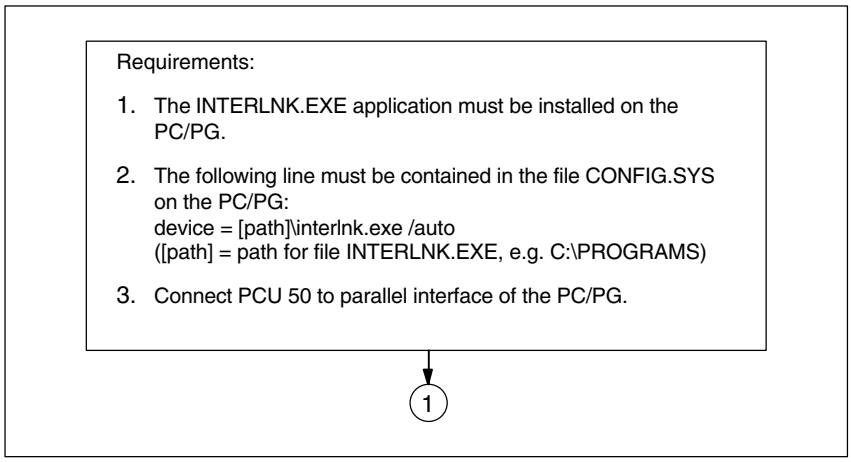


Fig. 4-4 Installation via parallel interface (FAT 32)

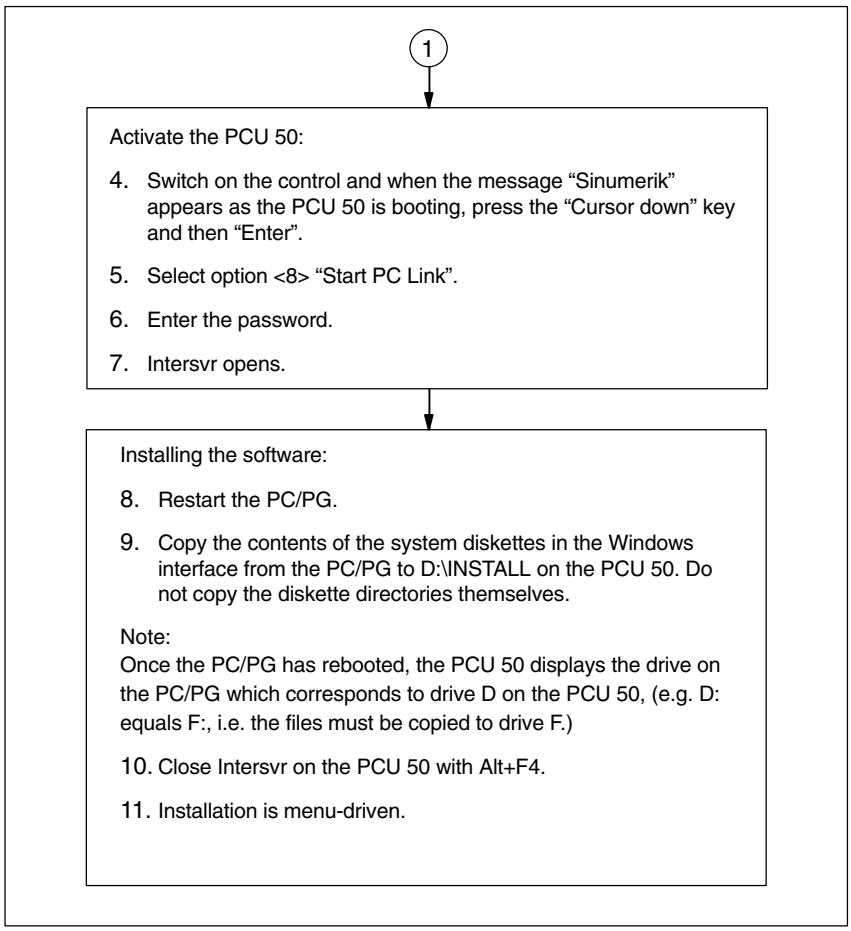


Fig. 4-5 Installation via parallel interface (FAT 32)

Installation via floppy drive

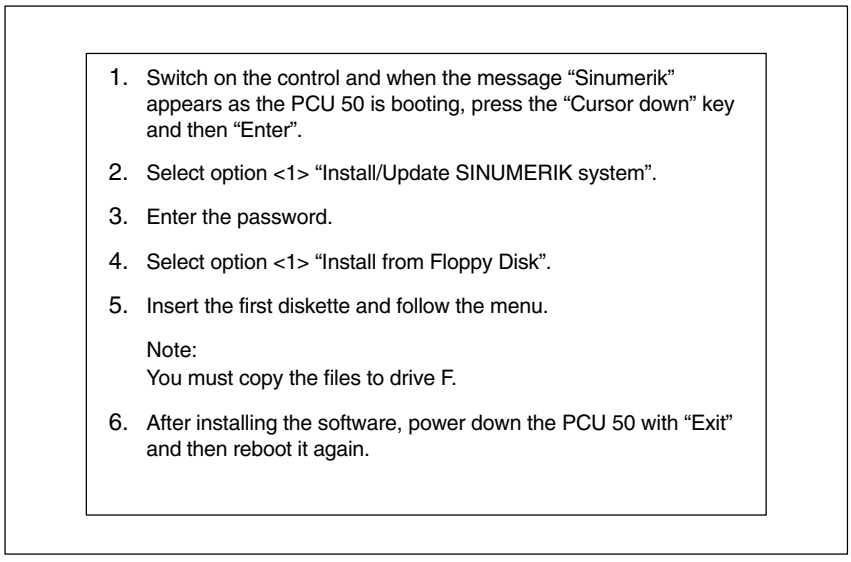


Fig. 4-6 Installation via floppy drive

Installation via a network link

The software is downloaded from the PC/PG to the D:\INSTALL directory on the PCU 50. It is automatically installed the next time the PCU 50 boots.
In the example below the PC/PG has computer number r3344 and the software to be installed is located in the SHOPMILL\SM_INST directory.

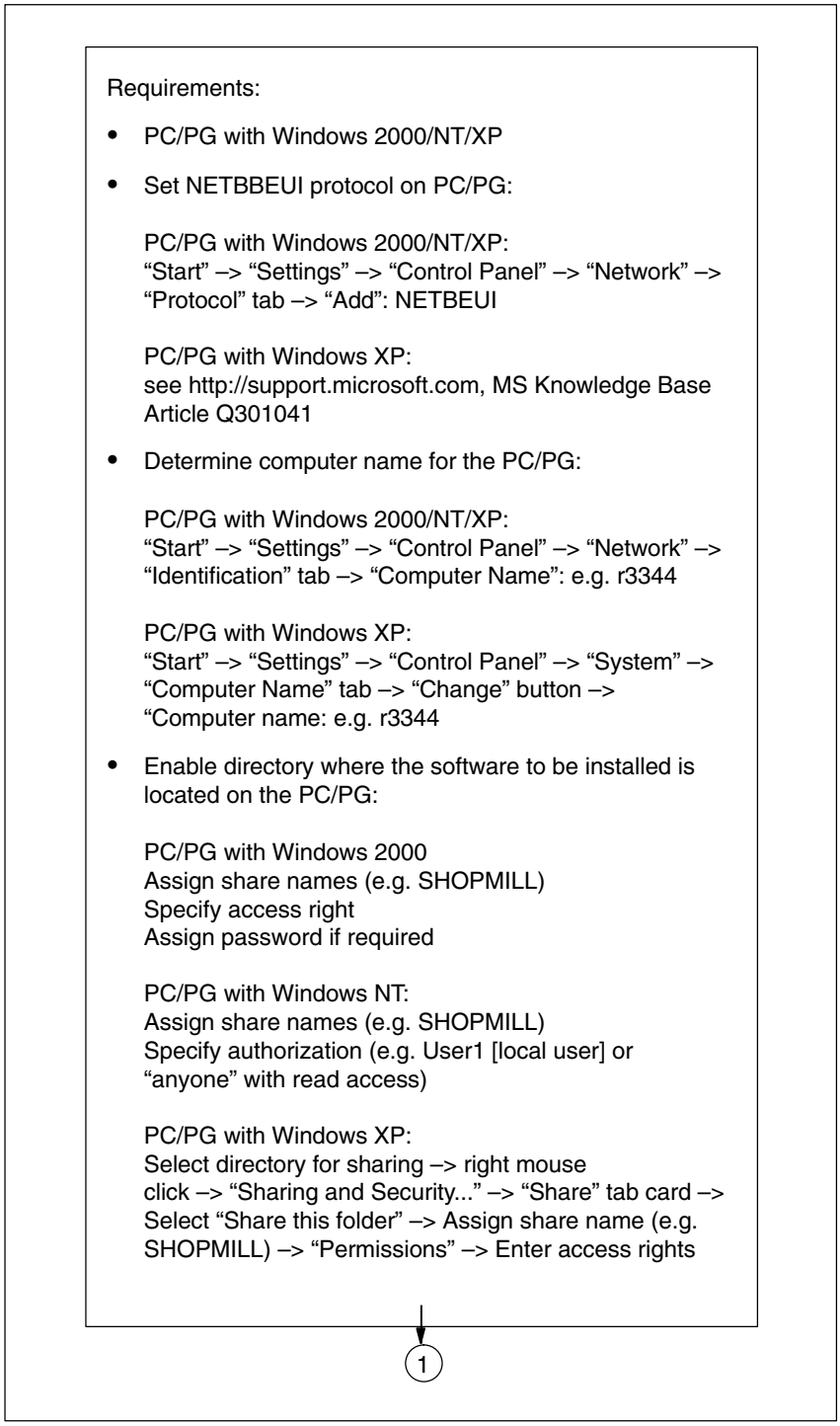


Fig. 4-7 Installation via a network link

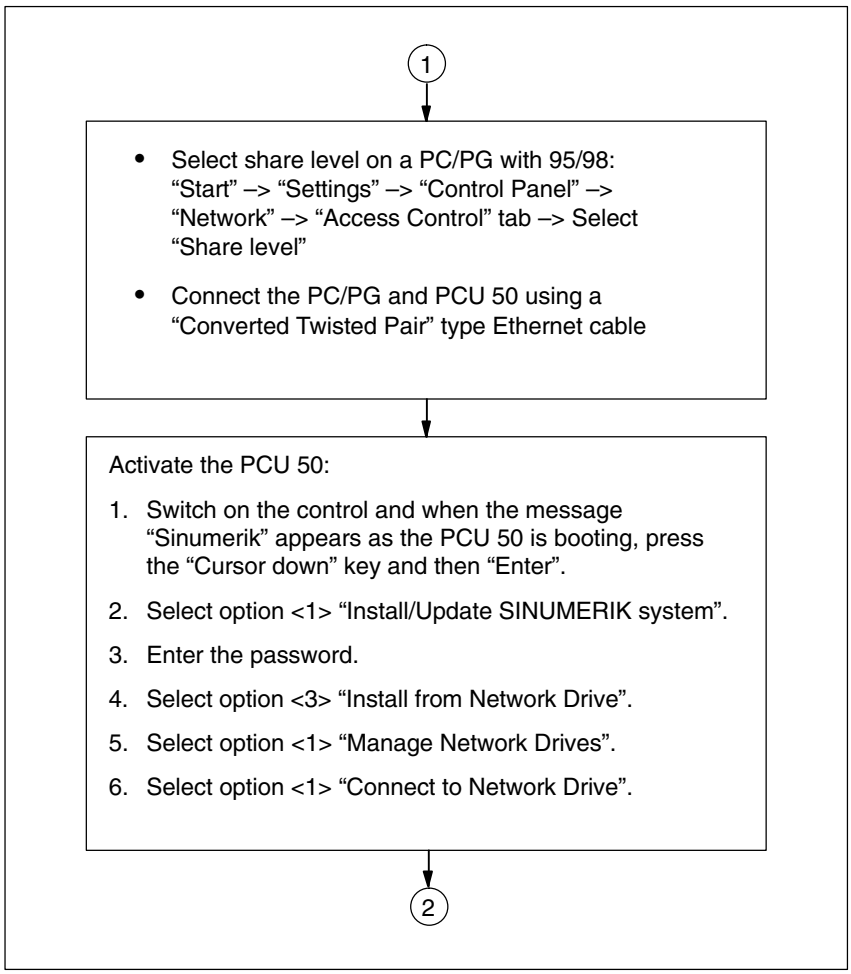


Fig. 4-8 Installation via a network link

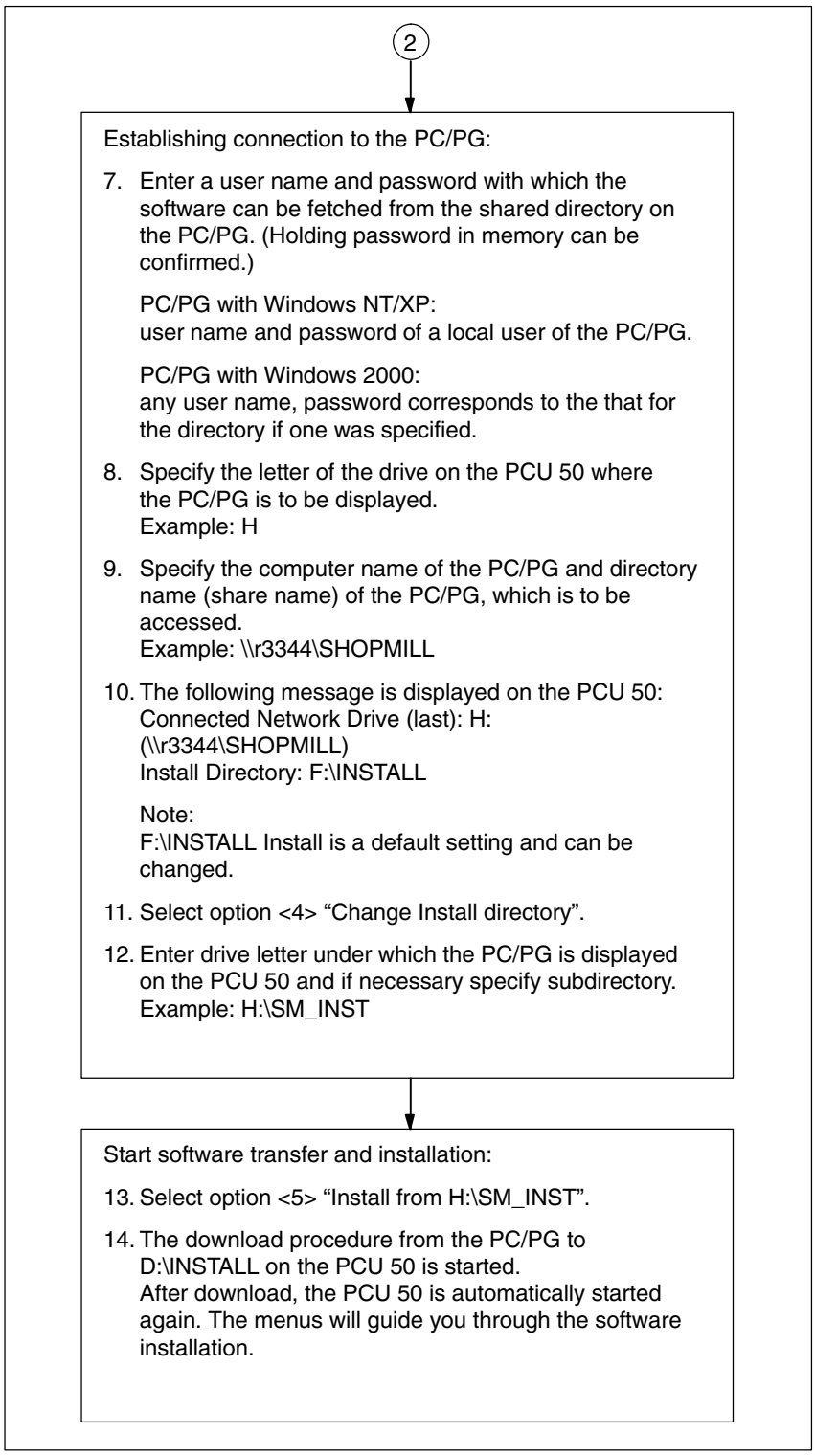


Fig. 4-9 Installation via a network link

Languages

The ShopMill software package includes 6 languages (German, English, French, Italian, Spanish and Chinese).
The foreground language is always German.
To select the background language, press the softkeys “MMC” and “Languages” in succession in the “Start-up” operating area on the CNC ISO operator interface and mark the desired language.
Use the “Change Language” softkey to toggle between the foreground and background language in the “Start-up” area of the CNC ISO operator interface.

4.2.4 NC start-up

Start-up of the NC includes the following items:

- Set up axes and spindles
- Load ShopMill machine data, definitions and cycles
- Set up tool management

You only have to set up the axes and spindles if you have not yet done so on the machine. Please observe the supplementary conditions when setting up the axes and spindles (see Chapter 2 “Supplementary Conditions”).

In the same way, you only have to set up tool management in the NC if none yet exists.

NC installation and start-up differ for the SINUMERIK 840D/810D and SINUMERIK 840Di.

SINUMERIK 840D/810D

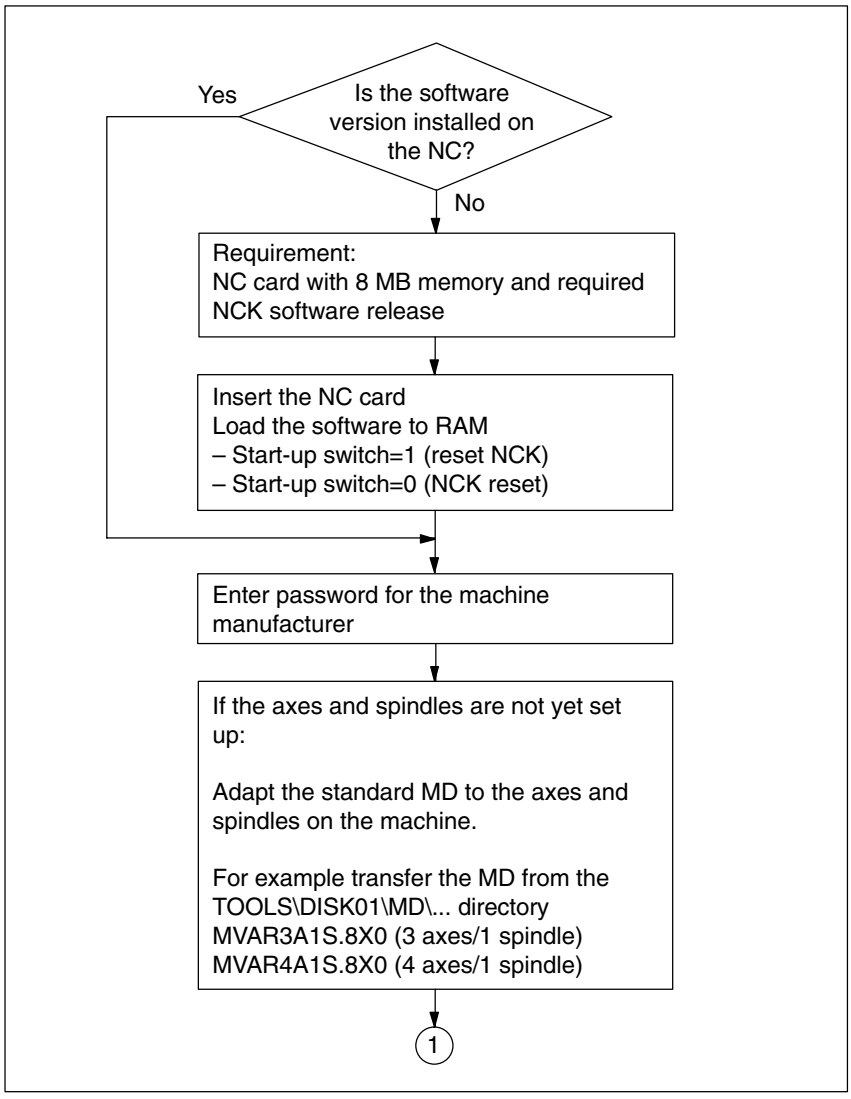


Fig. 4-10 NC SINUMERIK 840D/810D installation and start-up

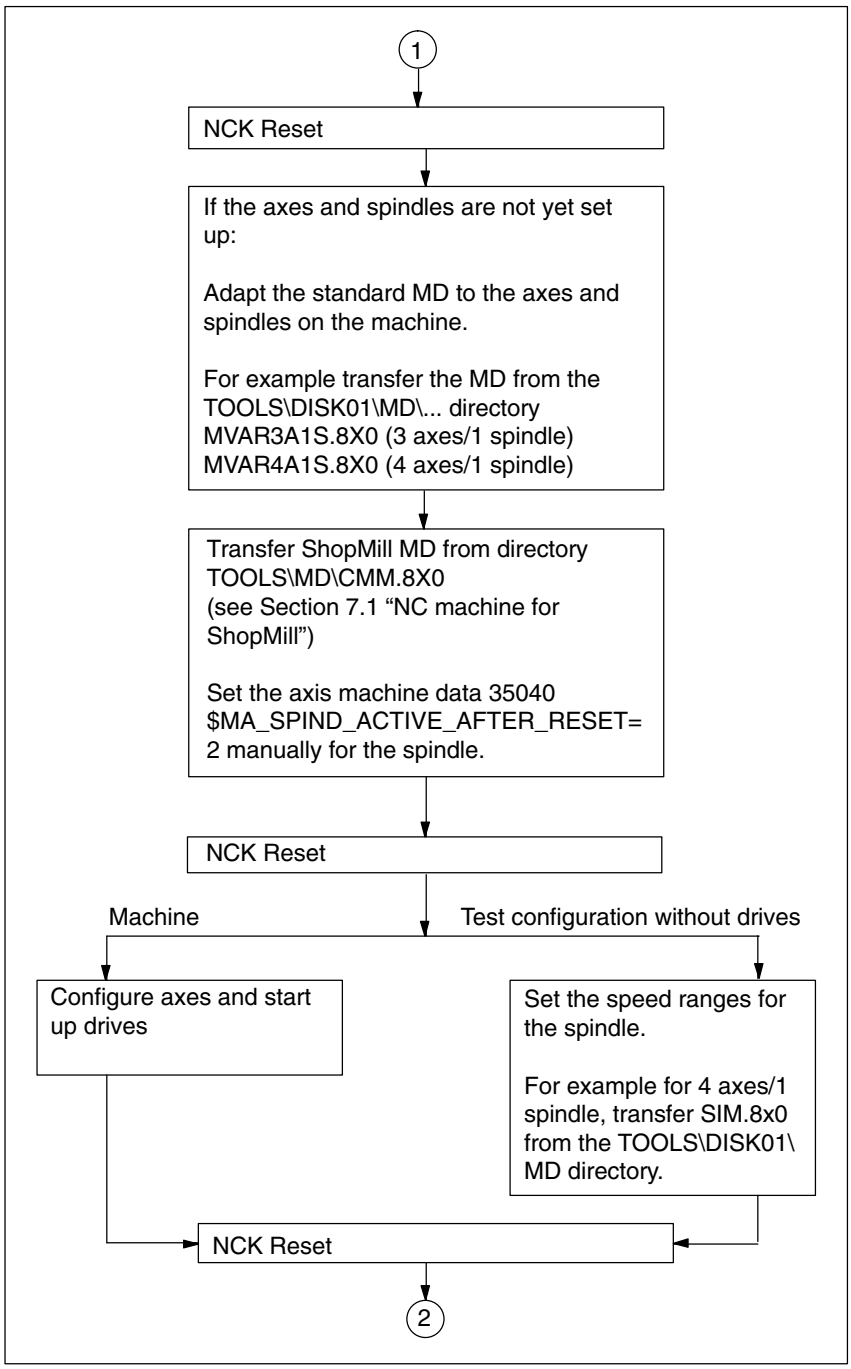


Fig. 4-11 NC SINUMERIK 840D/810D installation and start-up

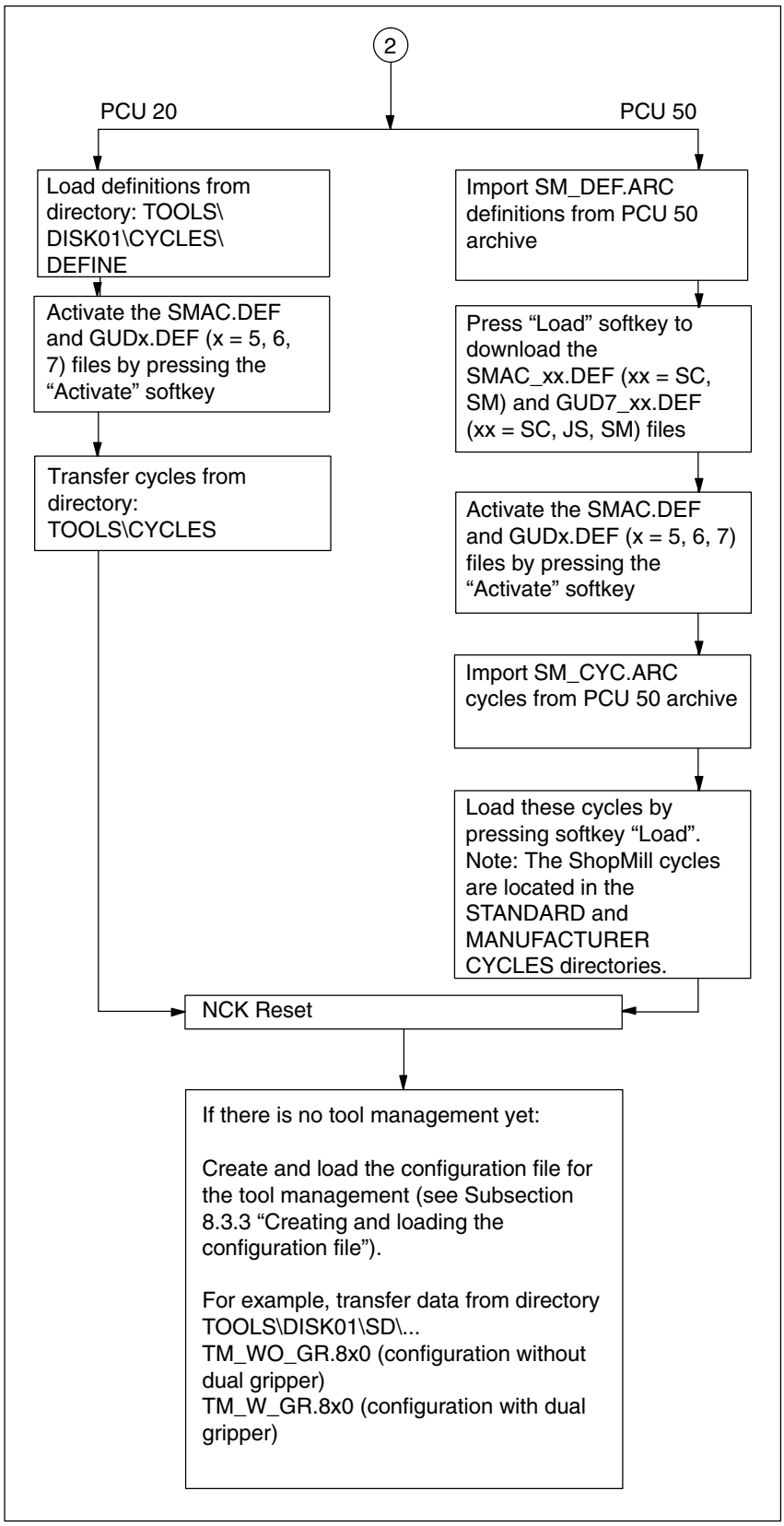


Fig. 4-12 NC SINUMERIK 840D/810D installation and start-up

SINUMERIK 840Di

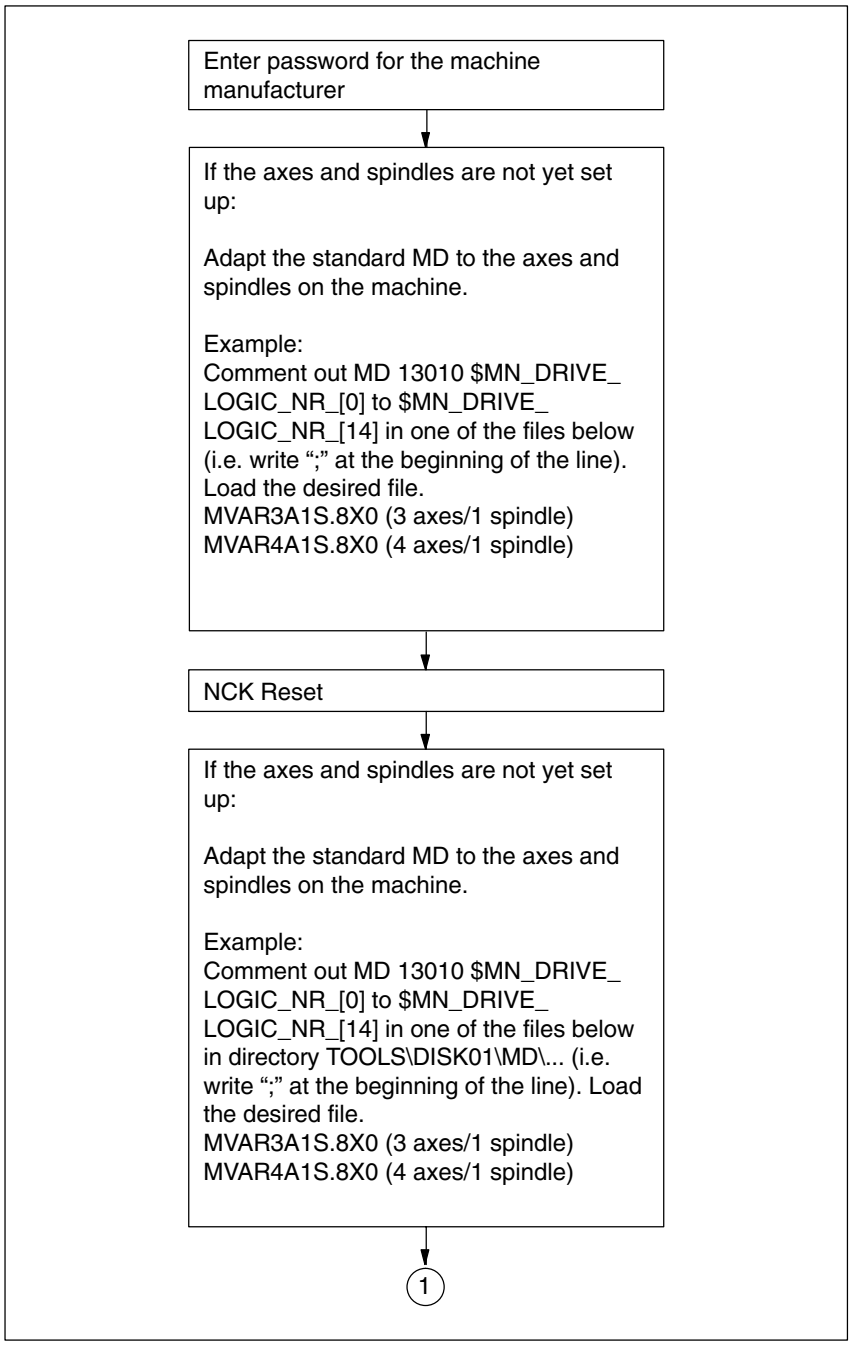


Fig. 4-13 NC SINUMERIK 840Di installation and start-up

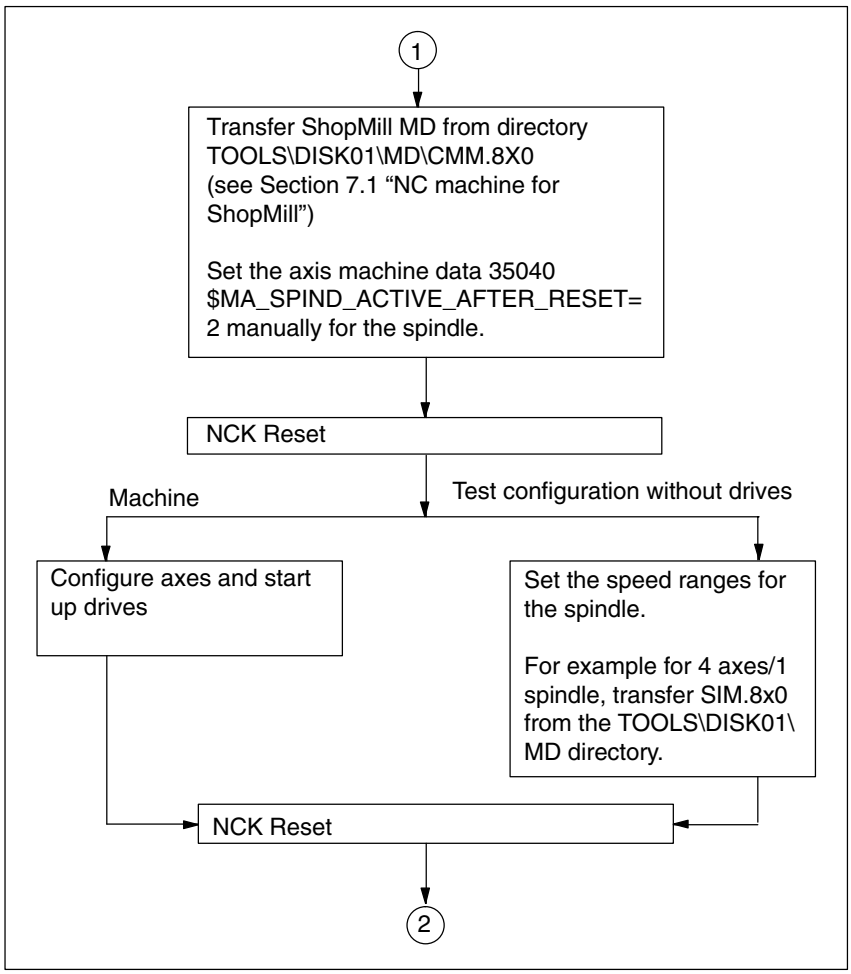


Fig. 4-14 NC SINUMERIK 840Di installation and start-up

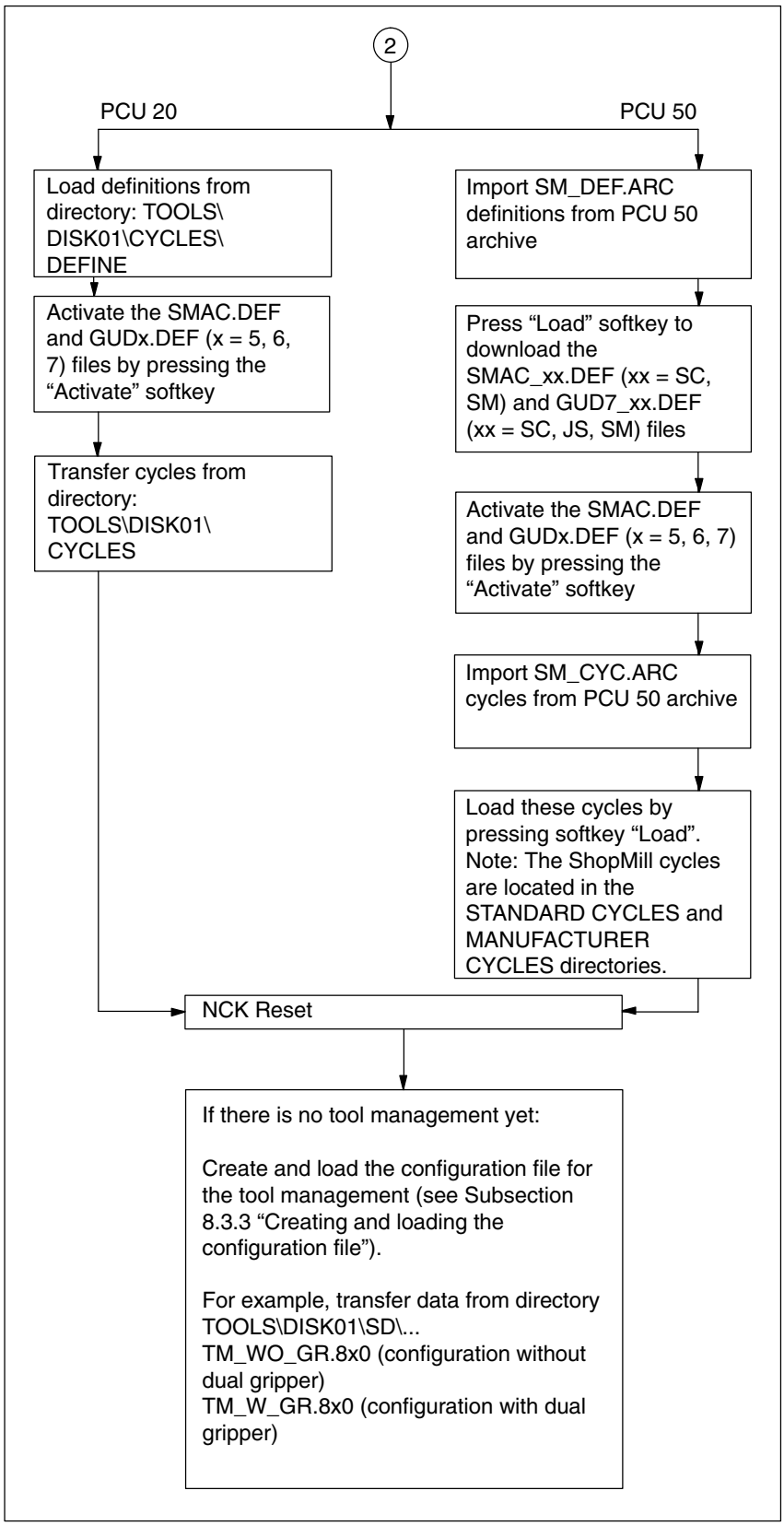


Fig. 4-15 NC SINUMERIK 840Di installation and start-up

4.2.5 PLC Start-up

You need to create and load a PLC user project prior to PLC startup.
For more detailed information on the PLC blocks, please refer to the Chapter 5 “PLC Program”.

Note

Before commencing with start-up, set the parameter mnemonic to German in the SIMATIC manager under Options Customize menu.

Proceed as follows to start up the PLC:

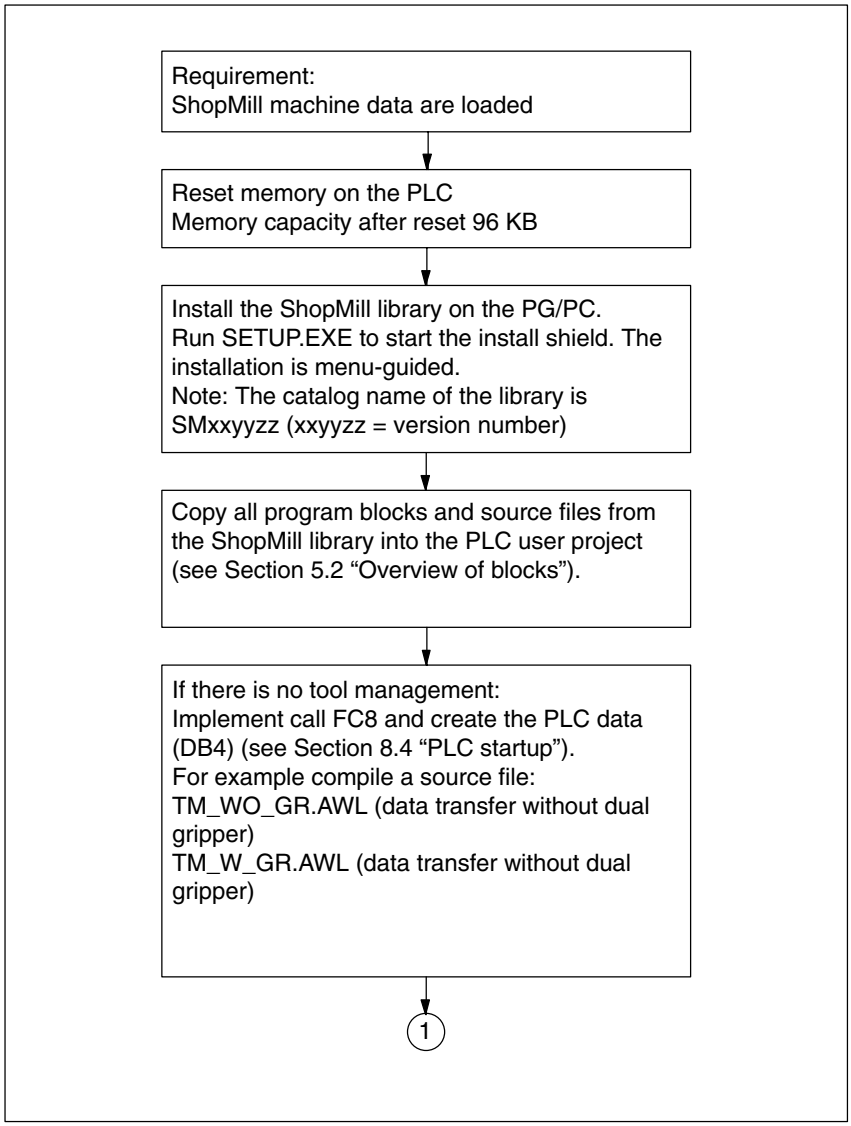


Fig. 4-16 PLC installation and start-up

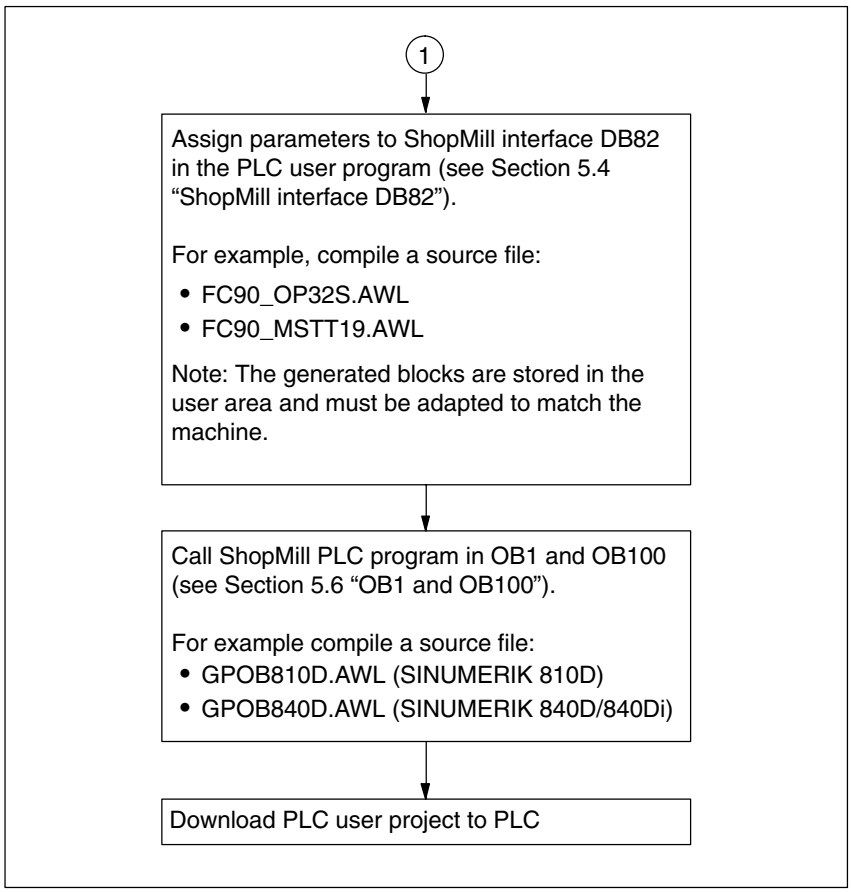


Fig. 4-17 PLC installation and start-up

4.2.6 Display machine data

Once you have completed installation of ShopMill on the PCU and start-up of the NC and the PLC you must adapt the display machine data.
The display machine data are listed in Section 7.2 “Display Machine Data for ShopMill”.

Note

You can copy your adapted display machine data from a PCU20 to a PCU50.
For more detailed information please refer to:
References: /IAM/, IM4 Installation and Start-up Guide HMI Advanced

4.2.7 Acceptance report

The acceptance certificate can be used to test the installed ShopMill functions once the ShopMill installation and startup have been completed.
The acceptance certificate is included on the ShopMill CD-ROM.

4.3 Series start-up

Series startup is used to install the software on multiple machines.
When setting up multiple machines, a standard software installation is performed on the first one (see Section 4.2 “First start-up”) and then an NC and PLC archive are created and read into the other machines.

When reading in these series start-up archives, you can choose between four different storage media:

- PG
  The start-up archives are saved on a programming device connected via the RS-232 interface. Please also observe the instructions for series startup in the manual:
  References: /IAD/, Installation and Start-Up Guide SINUMERIK 840D
  /IAC/, Installation and Start-Up Guide SINUMERIK 810D
  /HBI/, SINUMERIK 840Di Manual
- NC card
  The free memory (approx. 2 MB) on the NC card (PCMCIA card) can be used to save the start-up archive it contains.
- Hard disk (PCU 50 only)
  The start-up archives are saved to hard disk.
- Diskette (PCU 50 only)
  The start-up archives are saved to diskette.

The exact operating sequence is described in:
References: /BEM/, Operator’s Guide HMI Embedded or
/BAD/, Operator’s Guide HMI Advanced

Note

When you create an archive, you can save the NC and PLC separately or together.

When reading in the archive files, the NC archive must be read in first, then it is necessary to perform an NCK reset and, if necessary, a general PLC reset. Then the PLC archive is read in. Ensure that all the data in the NC or PLC is deleted and replaced with the data from the archive.

4.4 Upgrade

You will find information about upgrading ShopMill in file UPDATE_x.RTF.

■

Notes

PLC Program

5

5.1 Structure of the PLC program

In OBs 1, 40, and 100, the ShopMill PLC program, tool management, and the PLC basic program (FB1, FC2, ...) must be called up as shown in Fig. 5-1.

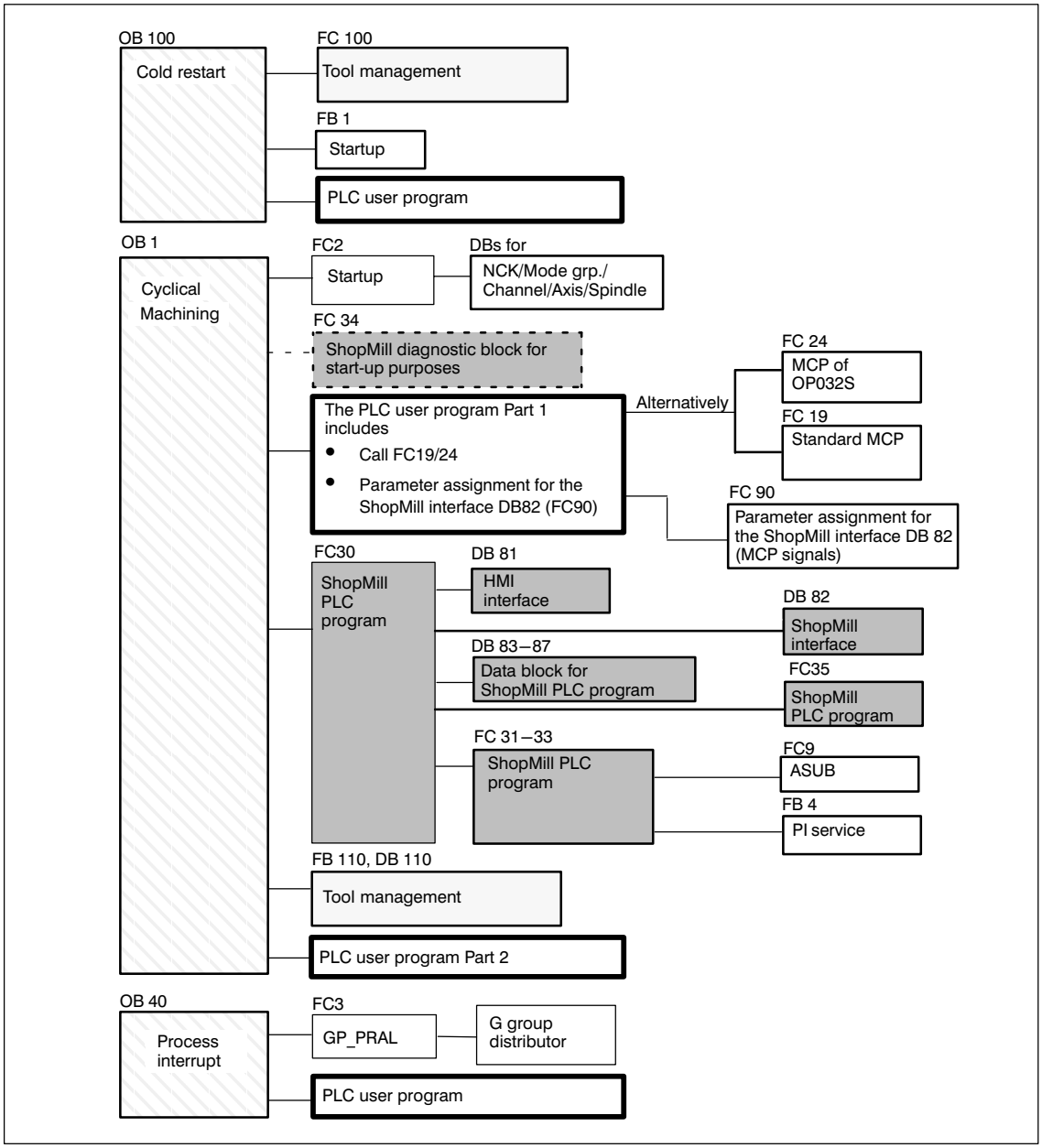


Fig. 5-1 Structure of the PLC program

5.2 Overview of blocks

The blocks used by ShopMill are listed below. These blocks must not be changed and must be used. A precise description of the blocks is given in the following sections.

Table 5-1 ShopMill blocks

Block	Comment
FC30	ShopMill PLC program Block called in OB 1.
FC 31–33	ShopTurn PLC program Blocks only loaded.
FC 34	Diagnostics block for monitoring the standard interface signals that are written by the ShopMill PLC program. Block can be called in OB1 for diagnostic purposes.
FC 35	ShopMill PLC program Blocks only loaded.
FB 20	HiGraphErrEmitterFB block for errors and monitoring time. Block only loaded.
DB 81	HMI interface
DB 82	ShopMill interface
DB 83–87	Data blocks for ShopMill PLC program

ShopMill also includes several source files for blocks as examples. You can adapt and compile these source files.
Alternatively you can also use your own blocks.

Table 5-2 Example source files

Source	Block	Comment
GPOB810D.AWL GPOB840D.AWL	OB1, OB40, OB100	Example blocks for the OB
FC90_MSTT19.AWL FC90_OP032S.AWL	FC 90	Sample block for supplying ShopMill interface DB82 Block can be called with OB1.
TM_W_GR.AWL TM_WO_GR.AWL	FC 100, FB 110, DB 110	Sample block for configuring tool management. Block is called in OB100. Sample block for data transfer of the tool management. Block is called in OB1. Instance data block for FB 110

A precise description of the example blocks is given in the following chapters. The example blocks for tool management are described in Chapter 9 “Tool Management”.

5.3 ShopMill PLC program

The ShopMill PLC program contains the following blocks:

FC 30...35

The function blocks FC 30–35 control the machine control panel functionality in DB 82 and HMI functionality in DB 81.

You must not change the numbers of function blocks FC 30 to 35. This means that you have to change any blocks that were assigned these numbers by the PLC user program.

ShopMill is much more than just an operator interface consisting of screen forms and images; in addition, it offers a complete operator system providing the user with the necessary functions for each control state. For example, the ShopMill operating mode “Manual” is not identical to the NCK operating mode “JOG”.

For example, in order to execute the functions “Zero workpiece”, “Measure tool”, “Position”, etc. in “Manual” mode, ShopMill switches automatically to NC operating mode “Automatic” at NC start and back again to “JOG” mode at the end of the function. Thus from the operator’s point of view, the manual functions are independent of the control operating modes of the NC.

This functionality, which is continued in the ShopMill “Automatic” mode, is implemented in the PCU (ShopMill operator interface) and in the PLC (ShopMill PLC program FC 30).

FB 20

Function block FB 20 collects alarms issued by ShopMill FC 30–33 and displays them.

Function block FB 20 is loaded only. It must be available in the automation system (AS) during operation. A block call is not required.

DB 81...87

Data blocks DB 81 and DB 82 form the HMI/ShopMill interface; data blocks 83–87 supply the ShopMill PLC program.

You must not change the numbers of function blocks FC 81 to 87. This means that you have to change any blocks that were assigned these numbers by the PLC user program.

5.4 ShopMill interface DB82

The ShopMill PLC program requires an interface to the PLC user program in addition to the internal interfaces to the user interface or to the NC interface. This is implemented in ShopMill interface DB82.

The machine control panel's signals (ShopMill operating modes Reset, Start, Stop, Spindle clockwise/counterclockwise/off, etc.) must be input into this interface by PLC user program part 1. The ShopMill PLC program then carries out the relevant actions and returns the current status to DB82. This can then be assessed by PLC user program part 2.

Please refer to Chapter 6 "Signal Description" for a detailed description of all the signals of ShopMill interface DB82.

Overview for active ShopMill PLC

The figure below shows the connections for the active ShopMill PLC program.

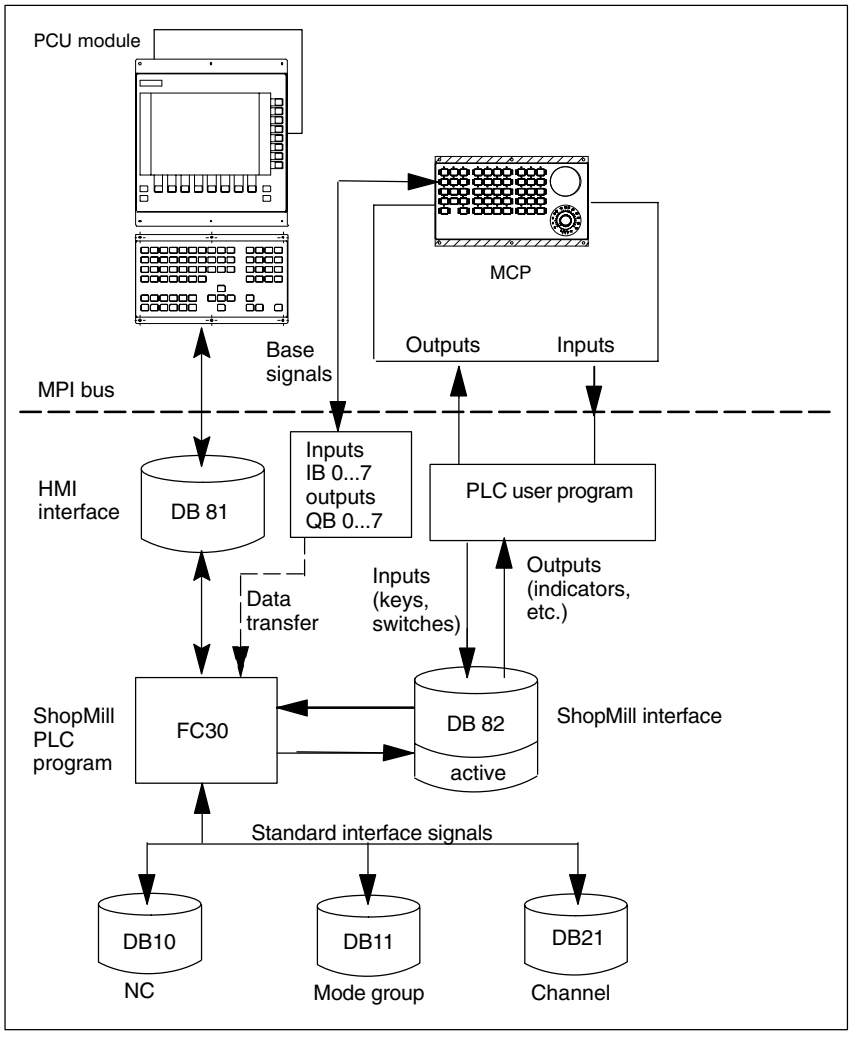


Fig. 5-2 ShopMill operation

A list of the standard interface signals that are affected by ShopMill PLC program FC 30 is given in Section 5.5 “Standard Interface Signals for/from ShopMill”.

Note

When the ShopMill operator interface is active, the ShopMill PLC program is also activated. This is displayed by the output signal DB82 DBX36.0 “cmm_plc_activ”=1. The ShopMill interface DB82 must be assigned parameters by the PLC user program. The data transfer of the base signals from IB0...7/QB0...7 is set via the DB82 DBB0 signal “transfer_base_sig”. The default interface signals allocated by the ShopMill PLC program must not be overwritten by the user.

5.5 Standard interface signals for/from ShopMill

The following section lists the standard interface signals that are affected by the ShopMill PLC program FC 30 (DB11 and DB21) or by the ShopMill interface (DB19).

Table 5-3 Standard interface signals for/from ShopMill

Byte		Designation
DB11		**Signals to BAG (PLC——>NCK)**
DBB0	Bit0 Bit1 Bit2	AUTOMATIC mode MDA mode JOG mode See /FB1/, Description of Functions, Basic Machine, K1
DBB1	Bit0 Bit1 Bit2	Machine function TEACH IN Machine function REPOS Machine function REF see /FB1/, Description of Functions, Basic Machine, K1
DB19		**Signals from operator panel (HMI——>PLC)**
DBX18	Bit0	Update tool data See Section 6.1 “HMI interface DB19”
DBX20	Bit6	Simulation active See Section 6.1 “HMI interface DB19”
DB21		**Signals to NCK channel (PLC——>NCK)**
DBB0	Bit3	Activate DRF See /FB1/, Description of Functions, Extended Functions, H1
DBB0	Bit5	Activate M01 See /FB1/, Description of Functions, Basic Machine, K1
DBB0	Bit6	Activate dry run feedrate See /FB1/, Description of Functions, Basic Machine, V1
DBB1	Bit7	Activate program testing See /FB1/, Description of Functions, Basic Machine, K1
DBB2	Bit0	Skip block See /FB1/, Description of Functions, Basic Machine, K1
DBB6	Bit2	Delete distance to go See /FB1/, Description of Functions, Basic Machine, A2
DBB7	Bit1 Bit3 Bit7	Cycle start Cycle stop Reset See /FB1/, Description of Functions, Basic Machine, K1
DB3X (X = 4 to 6)		**Signals to spindle (PLC——>NCK)**
DBB30	Bit0 Bit1 Bit2	Spindle stop Spindel start CW Spindle start CCW
DB3X (X = 4 to 6)		**Signals from spindle (NCK——>PLC)**
DBW86		M function for spindle See /FB1/, Description of Functions, Basic Machine, S1

Note

- If a mode group reset is used by the PLC user program, it must be ensured that DB82 DBX4.0, “base_sig.reset” is set simultaneously in the user program.
- If feed disable for a stationary spindle (DB3X.DBX61.4) has been implemented in the PLC user program it must not be activated with “rigid tapping” (DB3X.DBX84.3), because with “hole circle thread cutting with positioning to circle” the axes are positioned with feedrate.

Sample application “Simulation active”

The “Simulation active” signal is enabled by ShopMill as well as by the CNC ISO operator interface. This signal can be used, for example, in the user PLC to suppress inhibition of operating mode changes to allow the simulation routine to run under ShopMill. (An operating mode changeover takes place in the ShopMill PLC when the simulation run starts.)

5.6 OB1 and OB100

The structure of the PLC program is determined by the organization blocks OB1 and OB100.
OB1 and OB100 must receive the calls for the basic PLC program, machine control panel, ShopMill PLC program and tool management as well as the parameter assignment for the ShopMill interface.

You can implement these calls yourself or use the source files GPOB810D.AWL and GPOB840D.AWL from the ShopMill PLC library as an example. You must adapt and compile the source files.

The examples for OB1 and OB100 are illustrated below. The calls for the ShopMill PLC program and tool management are marked in bold type. You must not change the sequence in which the blocks in the example are called.

Example for OB 1

```
ORGANIZATION_BLOCK OB 1
        VERSION: 5.2
VAR_TEMP
        OB1_EV_CLASS:           BYTE;
        OB1_SCAN_1:             BYTE;
        OB1_PRIORITY:           BYTE;
        OB1_OB_NUMBR:           BYTE;
        OB1_RESERVED_1:         BYTE;
        OB1_RESERVED_2:         BYTE;
        OB1_PREV_CYCLE:         INT;
        OB1_MIN_CYCLE:          INT;
        OB1_MAX_CYCLE:          INT;
        OB1_DATE_TIME:          DATE_AND_TIME;

//Data for ShopMill

     START_UP:                  BOOL;

// INSERT USER-DATA FROM HERE

END_VAR

BEGIN

     // Basic program

        CALL FC 2;
//
        // INSERT USER PROGRAM PART 1 FROM HERE
//
        //First cycle of OB1 store into "START_UP"
        L #OB1_SCAN_1;
        L 1;
        ==I;
        = #START_UP;
//
        //Machine control panel/operator panel
        L       DB82.DBB0;
        L       0;
        ==I     ;
```

```
        JC      MOD0;
        //Small operator panel
        L       DB82.DBB0;
        L       1;
        ==I     ;
        JC      MOD1;
        //Standard operator panel 19''
        JU      FC90;
        //No operator panel selected
//
MOD0:   CALL FC24(
                BAGNo           :=B#16#1,
                ChanNo          :=B#16#1,
                SpindleIFNo     :=B#16#5,
                FeedHold        :=M100.0,
                SpindleHold     :=M100.1,
                SpindleDir      :=M100.2);
        JU FC 90;
//
MOD1:   CALL FC19(
                BAGNo           :=B#16#1,
                ChanNo          :=B#16#1,
                SpindleIFNo     :=B#16#5,
                FeedHold        :=M100.0,
                SpindleHold     :=M100.1);
//
FC90:   CALL FC90(
                SpindleIFNo     :=B#16#5);
//

//
        // ShopMill PLC program

        CALL FC 30(INIT_SD:= #START_UP);
        //Initialize ShopMill PLC program

        //Tool Management System

        CALL FB110, DB110;

        // INSERT USER PROGRAM PART 2 FROM HERE


END_ORGANIZATION_BLOCK
```

Example for OB 100

```
ORGANIZATION_BLOCK OB 100
     VERSION: 5.3
VAR_TEMP
     OB100_EV_CLASS:           BYTE;
     OB100_STRTUP:             BYTE;
     OB100_PRIORITY:           BYTE;
     OB100_OB_NUMBR:           BYTE;
     OB100_RESERVED_1:         BYTE;
     OB100_RESERVED_2:         BYTE;
     OB100_STOP:               WORD;
     OB100_RESERVED_3:         WORD;
     OB100_RESERVED_4:         WORD;
     OB100_DATE_TIME:          DATE_AND_TIME;
END_VAR

BEGIN

     //Tool Management System

     CALL FC 100(RealMagLoc :=30);
//number of locations in real magazine
//

     //Basic program

     CALL FB 1 , DB 7(
             MCPNum          :=1,
             MCP1In          :=P#E0.0,
             MCP1Out         :=P#A0.0,
             MCP1StatSend    :=P#A8.0
             MCP1StatRec     :=P#A12.0,
             MCP1BusAdr      :=14,
             MCP1Timeout     :=S5T#700MS,
             MCP1Cycl        :=S5T#200MS,
             MCPMPI          :=TRUE,
             NCCyclTimeout   :=S5T#200MS,
             NCRunupTimeout  :=S5T#50S);
             NCKomm          :=TRUE);

     // INSERT USER PROGRAM FROM HERE


END_ORGANIZATION_BLOCK
```

Note

The OB100 example applies to the SINUMERIK 810D. For SINUMERIK 840D/840Di you must set values `MCP1BusAdr:=6` and `MCPMPI:=FALSE`.

5.7 Machine control panel

The signals from the machine control panel must be passed on to the ShopMill interface DB 82.

You need to initialize the following signals in DB 82 as a minimum:

- DB82 DBB0 (transmission mode for MCP signals)
- DB82 DBB8 (assignment: Spindle axis data block)

Either use your own blocks or adapt the examples to block FC 90.

Example FC 90

The following sample source files are available in the ShopMill library for parameter assignment to ShopMill interface DB 82:

- FC90_MSTT19.AWL (key assignment for MCP19")
- FC90_OP32S.AWL (key assignment for MCP of the OP032S)

By compiling one of the above STL sources, block FC 90 is generated which automatically initializes the two above mentioned signals of DB 82.

With fixed transmission mode (DB82 DBB0), the ShopMill PLC transfers the signals from the input/output area of the machine control panel to the ShopMill interface DB82 (DBX2.0, DBX2.1, DBX4.0, DBX4.1, DBX4.2, DBX6.7, DBX30.0, DBX30.1, DBX32.1, DBX32.2, DBX34.7).

FC 90 must be called in OB1 in Part 1 of the PLC user program.

The key assignment for the examples is as follows:
keys which are assigned from ShopMill via DB 82 have a gray background.
For keys 1 to 10 symbols are provided in the substitute key set (see Chapter 1 "Hardware").

19" machine control panel

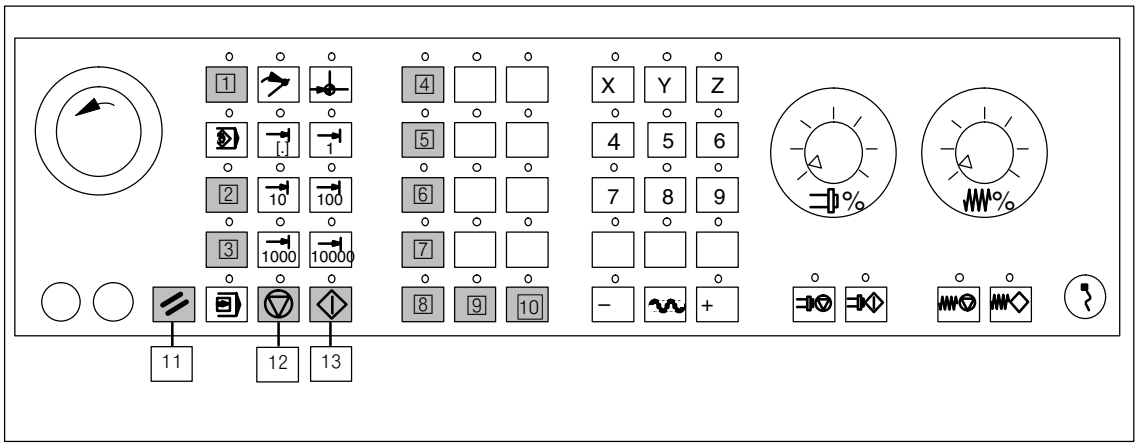


Fig. 5-3 Key assignment 19" machine control panel

1	Jog – MANUAL operating mode
2	MDI – MDI operating mode
3	Auto – AUTO operating mode
4	Tool Offset – Tool operating area
5	Program Manager – Directory operating area
6	Alarm – Alarms operating area
7	Program – Program operating area
8	Spindle rotation counterclockwise (M4) and Spindle Start
9	Spindle Stop (M5)
10	Spindle rotation clockwise (M3) and Spindle Start
11	Reset
12	Cycle Stop
13	Cycle Start

Machine control panel OP032S

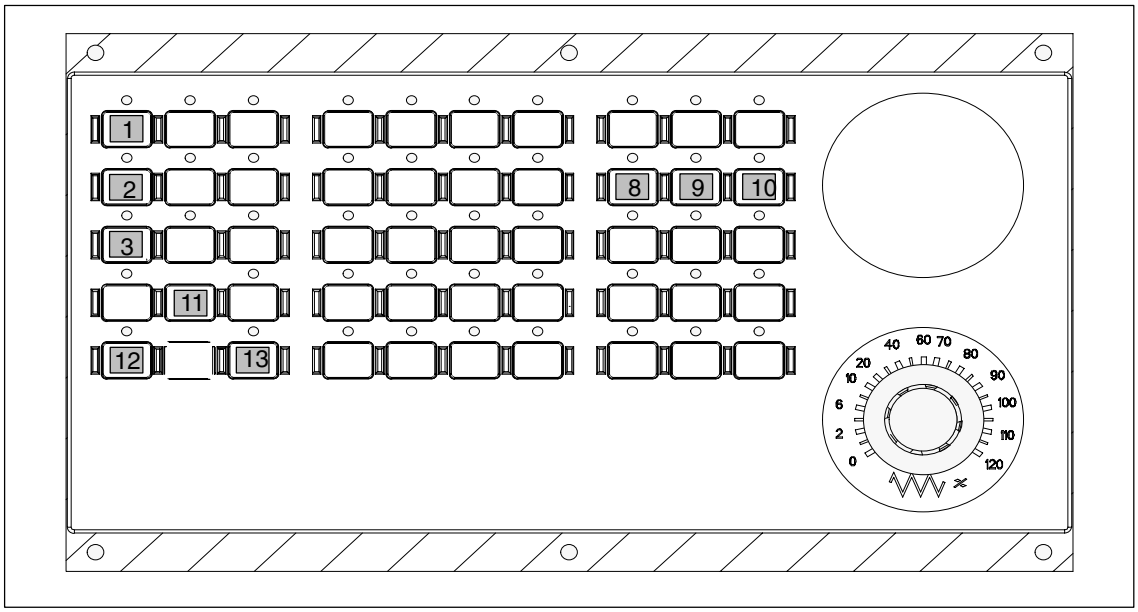


Fig. 5-4 Key assignment machine control panel for OP032S

1	Jog – MANUAL operating mode
2	MDI – MDI operating mode
3	Auto – AUTO operating mode
8	Spindle rotation counterclockwise (M4) and Spindle Start
9	Spindle Stop (M5)
10	Spindle rotation clockwise (M3) and Spindle Start
11	Reset
12	Cycle Stop
13	Cycle Start

Note

The operating areas for tool, directory, alarms and program can be selected via hard keys on the CNC keyboard for OP032S.

Latching logic

The latching logic/backup logic in the PLC user program for signals DB82 DBX4.1, “base_sig.nc_cycle_start” and DB82 DBX9.1, “spindle_start” must not take place directly in the NCK interface, but must act on the assigned input signals in EB0...7 on the MCP.
In addition signal DB21 DBX7.0, “NC start disable” can become active if the start is invalid.
The latching signals must be implemented in the PLC user program part before FC19/FC24.

5.8 Diagnostics function for start-up purposes

Description

If you would like to monitor the standard interface signals influenced during ShopMill startup, (see Section 5.5 “Standard interface signals for/from ShopMill”), use the diagnostic block FC 34.
The standard interface signals must **not** be modified by the PLC user program. If changes in the signals take place, the diagnostics block indicates this error in its circular buffer for error messages (20 entries possible). If a signal is cyclically changed, a new entry is conducted in the error message buffer in each PLC cycle. This function is activated via the data block DB82 DBX60.0.

Example

Initialize diagnostics function:
DBX60.0 = 1 (monitor_on)
DBX60.1 = 1 (monitor_initialize)

Activate diagnostics function;
DBX60.0 = 1 (monitor_on)
DBX60.1 = 0 (monitor_initialize)

Feedback from diagnostic function:
Error message1 (e.g. for DB11DBX0.1)

DBW62	current_number # 0 (error event count)	1
DBB64	db_number (output decimal)	11
DBB65	byte_number (output decimal)	0
DBB66	bit_number (output decimal)	1

error message 2 (e.g. for DB21DBX7.1)

DBW68	current_number # 0 (error event count)	2
DBB70	db_number (output decimal)	21
DBB71	byte_number (output decimal)	7
DBB72	bit_number (output decimal)	1

etc. ...

Call-up

The function block in OB1 must be called in the following sequence:

FC2	Basic program block
FC34	Diagnostics block
	PLC user program Part 1 (Interlocking logic, FC19/24 machine control panel block)
FC30	ShopMill PLC program
FB110	Data transfer block for ShopMill tool management in standard mode
	PLC user program part 2

Note

The tool box (PLC library) contains the example VAT82 for the variable table.

■

Signal Description

6

6.1 HMI interface DB19

DB19 **DBX18.0** Data Block	get_tool_data **Update tool data** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 6.3
Significance of signal	1: The tool data is updated. When this process is finished, the signal is reset again by the ShopMill user interface.		

DB19 **DBX20.6** Data Block	E_SimActiv **Simulation active** Signal(s) from ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 5.3
Significance of signal	0: Exit simulation 1: Entry into the simulation		

6.2 Overview of ShopMill interface DB82

6.2.1 Signals to ShopMill (input signals)

Table 6-1 Signals to ShopMill (input signals)

Address	Name	Initial value	Comment
0	CMM_IN.transfer_base_sig	B#16#0	Transmission mode for MCP signals
2.0	CMM_IN.base_sig.main_mode_mill.manual	FALSE	ShopMill Manual operating mode
2.1	CMM_IN.base_sig.main_mode_mill.automatic	FALSE	ShopMill Automatic operating mode
4.0	CMM_IN.base_sig.reset	FALSE	RESET for ShopMill
4.1	CMM_IN.base_sig.nc_cycle_start	FALSE	Cycle Start
4.2	CMM_IN.base_sig.nc_cycle_stop	FALSE	Cycle Stop
6.0	CMM_IN.sub_mode_mill.tool	FALSE	Tool operating area
6.1	CMM_IN.sub_mode_mill.directory	FALSE	Directory operating area
6.2	CMM_IN.sub_mode_mill.messages	FALSE	Alarms/Messages operating area
6.3	CMM_IN.sub_mode_mill.program	FALSE	Program operating area
6.4	CMM_IN.sub_mode_mill.oem1	FALSE	Signal not used by ShopMill
6.5	CMM_IN.sub_mode_mill.oem2	FALSE	Signal not used by ShopMill
6.6	CMM_IN.sub_mode_mill.customer	FALSE	Signal not used by ShopMill
6.7	CMM_IN.sub_mode_mill.mda	FALSE	MDI operating area
8	CMM_IN.spindle_interface_number	B#16#5	Assignment of spindle/axis data record
9.0	CMM_IN.user_defined_spindle_control	FALSE	User-defined spindle control
9.1	CMM_IN.spindle_start	FALSE	Spindle start; signal no longer used as of version 6
9.2	CMM_IN.spindle_stop	FALSE	Spindle stop
9.3	CMM_IN.spindle_left	FALSE	Direction of spindle rotation counterclockwise; signal causes spindle start as of version 6
9.4	CMM_IN.spindle_right	FALSE	Direction of spindle rotation clockwise; signal causes spindle start as of version 6
9.5	CMM_IN.program_extern_selected	FALSE	Program is selected in the PLC
9.6	CMM_IN.disable_cnc_standard	FALSE	Disable switchover to CNC ISO operator interface
9.7	CMM_IN.cmm_activ_in_cnc_mode	TRUE	ShopMill PLC active during CNC ISO operation
10.0	CMM_IN.program_test_request	FALSE	Select Program test function
10.1	CMM_IN.dry_run_request	FALSE	Select DryRun function
10.2	CMM_IN.m01_request	FALSE	Select M01 function
10.3	CMM_IN.skip_block_request	FALSE	Select Skip Block function
10.4	CMM_IN.boot_standard	FALSE	System boot on CNC ISO operator interface
10.5	CMM_IN.nck_auto_req	FALSE	Preparation of PLC block search
10.6	CMM_IN.spindle_act_m30_reset	FALSE	Spindle active after M30 and reset; no longer operative as of version 6
10.7	CMM_IN.ignore_nck_alarm	FALSE	Ignore NCK alarm on cycle start
11.1	CMM_IN.get_tool_data	FALSE	Update tool data

Table 6-1 Signals to ShopMill (input signals)

Address	Name	Initial value	Comment
11.2	CMM_IN.c_axis_feed_drive	FALSE	This signal is not evaluated by ShopMill
11.3	CMM_IN.select_spindle_readout_0	FALSE	This signal is not evaluated by ShopMill
11.4	CMM_IN.select_spindle_readout_1	FALSE	This signal is not evaluated by ShopMill
11.5	CMM_IN.drf_request	FALSE	Select DRF function
12	CMM_IN.ext_m_cmd_1	100	1. extended M function for output of tool-specific functions
13	CMM_IN.ext_m_cmd_2	101	2. extended M function for output of tool-specific functions

6.2.2 Signals from ShopMill (output signals)

Table 6-2 Signals from ShopMill (output signals)

Address	Name	Initial value	Comment
30.0	CMM_OUT.base_sig.main_mode_mill.manual	FALSE	ShopMill Manual operating mode
30.1	CMM_OUT.base_sig.main_mode_mill.automatic	FALSE	ShopMill Automatic operating mode
32.0	CMM_OUT.base_sig.reset	FALSE	Reset performed
32.1	CMM_OUT.base_sig.nc_cycle_activ	FALSE	Cycle active
32.2	CMM_OUT.base_sig.nc_cycle_stopped	FALSE	Cycle interrupted
34.0	CMM_OUT.sub_mode_mill.tool	FALSE	Tool operating area activated
34.1	CMM_OUT.sub_mode_mill.directory	FALSE	Directory operating area activated
34.2	CMM_OUT.sub_mode_mill.messages	FALSE	Alarms/messages operating area activated
34.3	CMM_OUT.sub_mode_mill.program	FALSE	Program operating area activated
34.4	CMM_OUT.sub_mode_mill.oem1	FALSE	Signal not used by ShopMill
34.5	CMM_OUT.sub_mode_mill.oem2	FALSE	Signal not used by ShopMill
34.6	CMM_OUT.sub_mode_mill.customer	FALSE	Signal not used by ShopMill
34.7	CMM_OUT.sub_mode_mill.mda	FALSE	MDI operating area selected
36.0	CMM_OUT.cmm_plc_activ	FALSE	ShopMill PLC active
36.1	CMM_OUT.cmm_mmc_active	FALSE	ShopMill operator interface active
36.2	CMM_OUT.spindle_start_req	FALSE	Spindle start requested (M3/M4 output to spindle)
36.3	CMM_OUT.spindle_stop_req	FALSE	Spindle stop requested, M5 output to spindle
36.4	CMM_OUT.spindle_right	FALSE	Spindle rotation clockwise preselected
36.5	CMM_OUT.spindle_left	FALSE	Spindle rotation counterclockwise preselected
36.7	CMM_OUT.ext_prog_sel	FALSE	External program selected for execution
37.0	CMM_OUT.program_selection_done	FALSE	HMI acknowledgement that a program has been selected
37.1	CMM_OUT.program_test_active	FALSE	Program test function is active
37.2	CMM_OUT.dry_run_active	FALSE	DryRun function is active

Table 6-2 Signals from ShopMill (output signals)

Address	Name	Initial value	Comment
37.3	CMM_OUT.m01_active	FALSE	M01 function is active
37.4	CMM_OUT.skip_block_activ	FALSE	Skip Block function is active
37.7	CMM_OUT.start_up_activ	FALSE	ShopMill boot active
38.1	CMM_OUT.tool_un_load_internal	FALSE	Load/unload tool without magazine loading:
38.2	CMM_OUT.drf_activ	FALSE	DRF function is active
38.3	CMM_OUT.nc_start_ineffective	FALSE	NC Start not active
42.0	CMM_OUT.tool_m_function.function_1_on	FALSE	Tool spec. Function 1 active
42.1	CMM_OUT.tool_m_function.function_2_on	FALSE	Tool spec. Function 2 active
42.2	CMM_OUT.tool_m_function.function_3_on	FALSE	Tool spec. Function 3 active
42.3	CMM_OUT.tool_m_function.function_4_on	FALSE	Tool spec. Function 4 active
42.4	CMM_OUT.tool_m_function.function_1_activ	FALSE	Tool spec. Function 1 valid
42.5	CMM_OUT.tool_m_function.function_2_activ	FALSE	Tool spec. Function 2 valid
42.6	CMM_OUT.tool_m_function.function_3_activ	FALSE	Tool spec. Function 3 valid
42.7	CMM_OUT.tool_m_function.function_4_activ	FALSE	Tool spec. Function 4 valid
44	CMM_OUT.mask_number	W#16#0	Current screen number of ShopMill

6.2.3 Diagnostics buffer signals

Table 6-3 Diagnostics buffer signals

Address	Name	Initial value	Comment
60.0	nck_signal_monitor.monitor_on	FALSE	Activate diagnostics function (input signal)
60.1	nck_signal_monitor.monitor_initialize	FALSE	Initialize diagnostics function (input signal)
62	nck_signal_monitor.access_error[1].current_number	W#16#0	Current number of error message 1 (output signal)
64	nck_signal_monitor.access_error[1].db_number	B#16#0	DB number of error message 1 (output signal)
65	nck_signal_monitor.access_error[1].byte_number	B#16#0	Byte number of error message 1 (output signal)
66	nck_signal_monitor.access_error[1].bit_number	B#16#0	Bit number of error message 1 (output signal)
68	nck_signal_monitor.access_error[2].current_number	W#16#0	Current number of error message 2 (output signal)
70	nck_signal_monitor.access_error[2].db_number	B#16#0	DB number of error message 2 (output signal)
71	nck_signal_monitor.access_error[2].byte_number	B#16#0	Byte number of error message 2 (output signal)
72	nck_signal_monitor.access_error[2].bit_number	B#16#0	Bit number of error message 2 (output signal)

Table 6-3 Diagnostics buffer signals

Address	Name	Initial value	Comment
. . .		. . .	
176	nck_signal_monitor.access_error[20]. current_number	W#16#0	Current number of error message 20 (output signal)
178	nck_signal_monitor.access_error[20]. db_number	B#16#0	DB number of error message 20 (output signal)
179	nck_signal_monitor.access_error[20]. byte_number	B#16#0	Byte number of error message 20 (output signal)
180	nck_signal_monitor.access_error[20]. bit_number	B#16#0	Bit number of error message 20 (output signal)

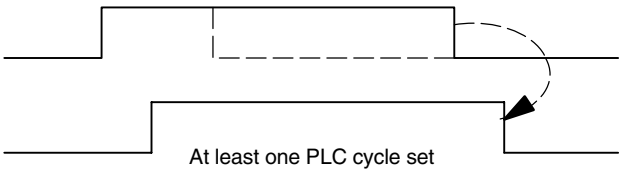
6.3 Description of ShopMill interface DB82

6.3.1 Signals to ShopMill (input signals)

DB82 **DBB0** Data Block	transfer_base_sig **Transmission mode for MCP signals** Signal(s) to ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	With this signal you determine whether the base signals of structure “base_sig” are to be used from the input/output are of the OP032S machine control panel or from the 19” machine control panel, i.e. the ShopMill PLC copies these input/output signals automatically to DB82. Value: 0 Default setting; OP032S machine control panel connection 1 19” machine control panel connection ≧ 2 No transfer of base signals; base signals must be transferred by user!		
Note	See Section 5.7 “Machine control panel”, subsection on latching logic for MCP signals		

DB82 **DBX2.0** Data Block	base_sig.main_mode_mill.manual **ShopMill Manual operating mode** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	Manual operating mode (“Machine manual”) is selected in ShopMill with this signal.		
Corresponding to...	DB82.DBB0		
Note	Effective only when DB82.DBB0=2 is set		
References	/BAS/, ShopMill Operator’s Guide		

DB82 **DBX2.1** Data Block	base_sig.main_mode_mill.automatic **ShopMill Automatic operating mode** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	Automatic operating mode (“Machine auto”) is selected in ShopMill with this signal.		
Corresponding to...	DB82.DBB0		
Note	Effective only when DB82.DBB0=2 is set		
References	/BAS/, ShopMill Operator’s Guide		

DB82 **DBX4.0** Data Block	base_sig.reset **Reset** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	Setting this signal triggers a channel-specific reset and the ShopMill PLC is reset. The active program is aborted.		
Timing diagram	CMM_IN. reset  CMM_OUT. reset At least one PLC cycle set		
Related to	DB82.DBB0; DB82.DBX32.0, base_sig.reset		
Note	Effective only when DB82.DBB0=2 is set • If mode group reset is used by the PLC user program, you must ensure that the CMM_IN.base_sig.reset signal is set at the same time. • If NC cannot perform a reset, e.g. emergency stop state is active, then there is no acknowledgment for the “CMM_OUT.base_sig.reset” signal. In this case, the channel-specific reset is pending at the NC interface for at least 2 sec.		

DB82 **DBX4.1** Data Block	base_sig.nc_cycle_start **Cycle Start** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Signal transition 0 ⟶ 1 ⟶ 0	• ShopMill Automatic operating mode Start of the selected part program Note: The ShopMill Automatic operating mode is not identical with NC Automatic mode. Switching from NC JOG to NC Auto only after Start and internal checking by the ShopMill status administration. • ShopMill Manual operating mode According to selected operator function: – Start of function in the screen form T, S, M, ... – Start of manual “Measure tool” with probe – Start of manual “Zero point workpiece” with probe – Start “Positioning” – Start of “Face milling”		
Related to	DB82.DBB0; DB82.DBX32.1, base_sig.nc_cycle_activ		
Note	Effective only when DB82.DBB0=2 is set		

DB82 **DBX4.2** Data Block	base_sig.nc_cycle_stop **Cycle Stop** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Signal transition 0 ⟶ 1	Interruption of active program		
Related to	DB82.DBB0; DB82.DBX32.2, base_sig.nc_cycle_stopped		
Note	Effective only when DB82.DBB0=2 is set		

DB82 **DBX6.0** Data Block	sub_mode_mill.tool **Tool operating area** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Edge change 0 ——> 1	This signal can also be implemented in the PLC user program via a customized key on the 19” machine control panel or via hardkeys on the full OP032S CNC keyboard. The appropriate operating area is displayed in ShopMill when you select this key.		
Signal state 0	No effect		
Related to	DB82, DBX34.0, sub_mode_mill.tool		

DB82 **DBX6.1** Data Block	sub_mode_mill.directory **Directory operating area** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Edge change 0 ——> 1	This signal can also be implemented in the PLC user program via a customized key on the 19” machine control panel or via hardkeys on the full OP032S CNC keyboard. The appropriate operating area is displayed in ShopMill when you select this key.		
Signal state 0	No effect		
Related to	DB82, DBX34.1, sub_mode_mill.directory		

DB82 **DBX6.2** Data Block	sub_mode_mill.messages **Alarms/Messages operating area** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Edge change 0 ——> 1	This signal can also be implemented in the PLC user program via a customized key on the 19” machine control panel or via hardkeys on the full OP032S CNC keyboard. The appropriate operating area is displayed in ShopMill when you select this key.		
Signal state 0	No effect		
Related to	DB82, DBX34.2, sub_mode_mill.messages		

DB82 **DBX6.3** Data Block	sub_mode_mill.program **Program operating area** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Edge change 0 ——> 1	This signal can also be implemented in the PLC user program via a customized key on the 19” machine control panel or via hardkeys on the full OP032S CNC keyboard. The appropriate operating area is displayed in ShopMill when you select this key.		
Signal state 0	No effect		
Related to	DB82, DBX34.3, sub_mode_mill.program		

DB82 **DBX6.7** Data Block	sub_mode_mill.mda **MDI operating area** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 5.3
Edge change 0 ——> 1	This signal can also be implemented in the user program via a customized key on the 19" machine control panel or via hardkeys on the full CNC keyboard in the case of an OP032S machine control panel. The appropriate operating area is displayed in ShopMill when you select this key.		
Signal state 0	No effect		
Note	Effective only when DB82.DBB0=2 is set		
Related to	DB82, DBX34.7, sub_mode_mill.mda		

DB82 **DBB8** Data Block	spindle_interface_number **Assignment of spindle/axis data record** Signal(s) to ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	This signal can be used to assign the spindle to an axis data record. Enter the number of the machine axis.		
Corresponding to...	ShopMill SW release 5.3 and higher: MD 9705 CMM_INDEX_SPINDLE, enter the number of the channel axis here.		

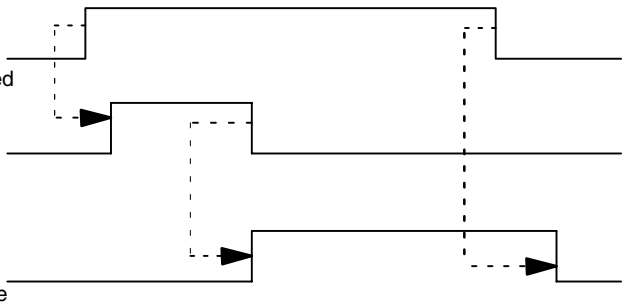
DB82 **DBX9.0** Data Block	user_defined_spindle_control **User-defined spindle control** Signal(s) to ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 6.2
Signal state 0	The spindle control is supported by the ShopMill PLC. Interface signals DB82.DBX9.1 to DB82.DBX9.4 and DB82.DBX36.2 to DB82.DBX36.5 are active. In the axis DB of the spindle, interface signals DB3x.DBX30.0 to DB3x.DBX30.2 are written (see also Section 11.3 "Spindle control").		
Signal state 1	The spindle control is not supported by the ShopMill PLC. Interface signals DB82.DBX9.1 to DB82.DBX9.4 and DB82.DBX36.2 to DB82.DBX36.5 have no function and interface signals DB3x.DBX30.0 to DB3x.DBX30.2 are not written. The spindle must be controlled in the user PLC.		

DB82 **DBX9.1** Data Block	spindle_start **Spindle start** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Signal transition 0 ——> 1	The spindle start is only performed if a direction of rotation is selected at the same time via interface signal DB3x.DBX30.1 or DB3x.DBX30.2. Please comply with the instructions in Section 11.3 "Spindle control". This signal is no longer used as from ShopMill version 6. The spindle start is performed with the selection of the rotation direction spindle_left or spindle_right.		
Signal state 0	No effect		
Related to	DB82, DBX36.2, spindle_start_req DB82, DBX9.3, spindle_left DB82, DBX9.4, spindle_right		

DB82 **DBX9.2** Data Block	spindle_stop **Spindle stop** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Signal transition 0 ——> 1	Spindle stop is performed via interface signal DB3x.DBX30.0. Please comply with the instructions in Section 11.3 “Spindle control”.		
Signal state 0	No effect		
Related to	DB82, DBX36.3, spindle_stop_req		

DB82 **DBX9.3** Data Block	spindle_left **CCW spindle rotation** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Signal transition 0 ——> 1	The selection of the direction of spindle rotation (left) acts as spindle start.		
Signal state 0	No effect		
Related to	DB82, DBX36.5, spindle_left		
References	/BAS/, ShopMill Operator’s Guide		

DB82 **DBX9.4** Data Block	spindle_right **CW spindle rotation** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Signal transition 0 ——> 1 ——> 0	The selection of the direction of spindle rotation (right) acts as spindle start.		
Signal state 0	No effect		
Related to	DB82, DBX36.4, spindle_right		
References	/BAS/, ShopMill Operator’s Guide		

DB82 **DBX9.5** Data Block	program_extern_selected **Program is selected in the PLC** Signal(s) to ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	When the signal is set, it is possible to select an NC part program externally from the PLC.		
Timing diagram			
Related to	DB82, DBX37.0, program_selection_done		
References	/BAS/, ShopMill Operator’s Guide		

DB82 **DBX9.6** Data Block	disable_cnc_standard **Disable switchover to CNC ISO operator interface** Signal(s) to ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	When the signal is set, switchover from ShopMill to the CNC ISO operator interface can be disabled.		

DB82 **DBX9.7** Data Block	cmm_active_in_cnc_mode **ShopMill PLC active during CNC ISO operation** Signal(s) to ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	Value: 0: ShopMill PLC is not active during CNC ISO operation. You must not use this setting with ShopMill Open. 1: ShopMill is active during CNC ISO operation. You must use this setting with ShopMill Open.		
Application example(s)	Switchover between CNC ISO and ShopMill operation is possible at any time (even when a program is active and running).		

DB82 **DBX10.0** Data Block	program_test_request **Select Program test function** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.4
Signal transition 0 ——> 1	This signal can be implemented in the PLC user program via a customized key on the machine control panel. Pressing this key activates/deactivates the program test function.		

DB82 **DBX10.1** Data Block	dry_run_request **Select DryRun function** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.4
Signal transition 0 ——> 1	This signal can be implemented in the PLC user program via a customized key on the machine control panel. Pressing this key activates/deactivates the DryRun function.		

DB82 **DBX10.2** Data Block	m01_request **Select M01 function** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.4
Signal transition 0 ——> 1	This signal can be implemented in the PLC user program via a customized key on the machine control panel. Pressing this key activates/deactivates the M01 function.		

DB82 **DBX10.3** Data Block	skip_block_request **Select Skip Block function** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 5.1
Signal transition 0 ——> 1	This signal can be implemented in the PLC user program via a customized key on the machine control panel. Pressing this key activates/deactivates the Skip Block function.		

DB82 **DBX10.4** Data Block	boot_standard **System boot on CNC ISO operator interface** Signal(s) to ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	Setting this signal forces the system to boot on the CNC ISO operator interface. If the signal is reset again, it is possible to switch over to the ShopMill operator interface.		

DB82 **DBX10.5** Data Block	nck_auto_req **Preparation of PLC block search** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 5.3
Signal transition 0 ——> 1	Switchover on the NCK from JOG to AUTO can be requested with this signal.		
Signal state 0	No effect		
Application example(s)	Block search via PLC		
Related to	DB19, DBX6.0, signals from mode group (NCK —> PLC) active AUTOMATIC mode		

DB82 **DBX10.6** Data Block	spindle_act_m30_reset **Spindle active after M30 and Reset** Signal(s) to ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid as from SW version: ShopMill 5.3; no longer effective in Version 6 and higher
Signal transition 0 ——> 1	The spindle is not switched off at program end and on reset. The spindle must be switched off in the user PLC.		
Signal state 0	The spindle is switched off at program end and on reset by the ShopMill PLC.		

DB82 **DBX10.7** Data Block	ignore_nck_alarm **Ignore NCK alarm on cycle start** Signal(s) to ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 5.3
Significance of signal	With an active NCK alarm (DB10.DBX109.0 = 1), e.g. battery alarm, the following applies: 0: Cycle Start not possible 1: Cycle start possible Alarms – EMERGENCY OFF(DB10.DBX106.1 = 1) – NCK alarm with operational stop(DB21.DBX36.7 = 1) cannot be suppressed with this interface signal, i.e. cycle start is not possible in these cases.		

DB82 **DBX11.1** Data Block	get_tool_data **Update tool data** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 5.3
Signal state 1 or signal transition 0 ——> 1	The tool data is updated. When this process is finished, the signal is reset again by the ShopMill PLC.		
Signal state 0 or signal transition 1 ——> 0	–		
Note	With ShopMill 6.3 and higher, use interface signal DB19 DBX18.0 instead of DB82 DBX11.1.		

DB82 **DBX11.5** Data Block	drf_request **Select DRF function** Signal(s) to ShopMill		
Edge evaluation: yes		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 6.3
Signal transition 0 ——> 1	This signal can be implemented in the PLC user program via a customized key on the machine control panel. Pressing this key activates/deactivates the DRF function.		

DB82 **DBB12** Data Block	ext_m_cmd_1 **1. extended M function for output of tool-specific functions** Signal(s) to ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 5.3
Signal state 1 or signal transition 0 ——> 1	ShopMill utilizes 2 extended M functions to output tool-specific functions. The number of the 1st extended M function is entered in this interface signal. At the same time, display machine data 9684 $MM_CMM_M_CODE_TOOL_BITS_1 must be set to this value. The default setting is 100, the maximum value 255.		
Signal state 0 or signal transition 1 ——> 0	–		
Related to	DB82, DBB13, ext_m_cmd_2, display machine data 9684 $MM_CMM_M_CODE_TOOL_BITS_1		

DB82 **DBB13** Data Block	ext_m_cmd_2 **2. extended M function for output of tool-specific functions** Signal(s) to ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 5.3
Signal state 1 or signal transition 0 ——> 1	ShopMill utilizes 2 extended M functions to output tool-specific functions. The number of the 2nd extended M function is entered in this interface signal. At the same time, display machine data 9685 $MM_CMM_M_CODE_TOOL_BITS_2 must be set to this value. The default setting is 101, the maximum value 255.		
Signal state 0 or signal transition 1 ——> 0	–		
Related to	DB82, DBB12, ext_m_cmd_1, display machine data 9685 $MM_CMM_M_CODE_TOOL_BITS_2		

6.3.2 Signals from ShopMill (output signals)

DB82 **DBX30.0** Data Block	base_sig.main_mode_mill.manual **Base signals – ShopMill Manual mode** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	The base signal indicates that the “Machine Manual” operating area is selected. The signal DB82.DBX36.1 cmm_mmc_activ must also be gated.		

DB82 **DBX30.1** Data Block	base_sig.main_mode_mill.automatic **Base signals – ShopMill Automatic mode** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	The base signal indicates that the “Machine Auto” operating area is selected. The signal DB82.DBX36.1 cmm_mmc_activ must also be gated.		

DB82 **DBX32.0** Data Block	base_sig.reset **Reset activated** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	The signal indicates that a channel-specific reset was performed.		

DB82 **DBX32.1** Data Block	base_sig.nc_cycle_active **Cycle active** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	The signal indicates that a program is active.		

DB82 **DBX32.2** Data Block	base_sig.nc_cycle_stopped **Cycle interrupted** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	The signal indicates that a program is interrupted.		

DB82 **DBX34.0** Data Block	sub_mode_mill.tool **Tool operating area activated** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	The signal indicates that the Tool operating area is selected.		

DB82 **DBX34.1** Data Block	sub_mode_mill.directory **Directory operating area activated** Signal(s) from ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	The signal indicates that the Directory operating area is selected.		

DB82 **DBX34.2** Data Block	sub_mode_mill.messages **Alarms/messages operating area activated** Signal(s) from ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	The signal indicates that the Alarms/Messages operating area is selected.		

DB82 **DBX34.3** Data Block	sub_mode_mill.program **Program operating area activated** Signal(s) from ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	The signal indicates that the Program operating area is selected.		

DB82 **DBX34.7** Data Block	sub_mode_mill.mda **MDI operating area selected** Signal(s) from ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 5.3
Significance of signal	The signal indicates that the MDI operating area is selected.		

DB82 **DBX36.0** Data Block	cmm_plc_active **ShopMill PLC active** Signal(s) from ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Signal state 1 or signal transition 0 ——> 1	The ShopMill PLC program is activated.		
Signal state 0 or signal transition 1——>0	The ShopMill PLC program is not active. The PLC user program can execute a CNC ISO operation.		
Special cases, errors, ...	The ShopMill PLC program becomes active when the ShopMill application is loaded in the user interface following activation of the ShopMill softkey or when the signal DB82 DBX9.7, “cmm_activ_in_CNC_mode” is set to “1”. After switching to CNC ISO operation, the ShopMill PLC program is only in an inactive state if the signal DB82 DBX9.7,“cmm_activ_in_CNC_mode” is set to “0”; otherwise the ShopMill PLC program remains in active state.		

DB82 **DBX36.1** Data Block	cmm_mmc_active **ShopMill operator interface active** Signal(s) from ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Signal state 1 or signal transition 0 ——> 1	The ShopMill operator interface is activated.		
Signal state 0 or signal transition 1——>0	The ShopMill operator interface is not active.		
Special cases, errors, ...	The ShopMill operator interface is activated when the ShopMill application is loaded to the CNC ISO operator interface via the ShopMill softkey.		

DB82 **DBX36.2** Data Block	spindle_start_req **Spindle start requested** Signal(s) from ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	The signal indicates that a spindle start has been requested and M3 or M4 has been executed.		

DB82 **DBX36.3** Data Block	spindle_stop_req **Spindle stop requested** Signal(s) from ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	The signal indicates that a spindle stop has been requested.		

DB82 **DBX36.4** Data Block	spindle_right **CW spindle rotation** Signal(s) from ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	This signal indicates that the plus travel command is applied at the spindle (DB3x.DBX64.7).		

DB82 **DBX36.5** Data Block	spindle_left **CCW spindle rotation** Signal(s) from ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3
Significance of signal	This signal indicates that the minus travel command is applied at the spindle (DB3x.DBX64.6).		

DB82 **DBX36.7** Data Block	ext_prog_sel **External program selected for execution** Signal(s) from ShopMill		
Edge evaluation: no		Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 5.3
Significance of signal	An external program has been selected for execution. External refers to all programs which are not stored in the NC main memory, including programs on the local hard disk, in the network drive or on other external data storage media. External programs are selected for execution via the “Execute hard disk” softkey.		

DB82 **DBX37.0** Data Block	program_selection_done **HMI acknowledgement that a program has been selected** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	The signal indicates that a program has been preselected via the PLC (FB 4 select).		
Related to	DB82, DBX9.5, program_extern_selected		

DB82 **DBX37.1** Data Block	program_test_active **Program test function is active** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.4	
Significance of signal	The signal indicates that the program test function is active.		

DB82 **DBX37.2** Data Block	dry_run_active **DryRun function is active** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.4	
Significance of signal	The signal indicates that the DryRun function is active.		

DB82 **DBX37.3** Data Block	m01_active **M01 function is active** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.4	
Significance of signal	The signal indicates that the M01 function is active.		

DB82 **DBX37.4** Data Block	skip_block_activ **Skip Block function is active** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 5.1	
Significance of signal	The signal indicates that the Skip Block function is active.		

DB82 **DBX37.7** Data Block	start_up_activ **ShopMill boot active** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 5.2	
Significance of signal	This signal indicates that the ShopMill operator interface has been selected by means of softkey “ShopMill”. It is reset if the ShopMill operator interface is deselected again (selection of “CNC-ISO”).		

DB82 **DBX38.1** Data Block	tool_un_load_internal **Load/unload tool without magazine loading** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 6.2	
Significance of signal	This signal is active when tool data are read in and existing tools are either deleted or new tools created.		

DB82 **DBX38.2** Data Block	drf_activ **DRF function is active** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 6.3	
Significance of signal	The signal indicates that the DRF function is active.		

DB82 **DBX38.3** Data Block	nc_start_ineffective **NC Start not active** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 6.3	
Signal state 1 or signal transition 0 ⟶ 1	NC Start was not acknowledged by the ShopMill operator interface, i.e. not enabled. This signal is reset at the next NC Start.		
Signal state 0 or signal transition 1 ⟶ 0	NC Start was acknowledged by the ShopMill operator interface, i.e. enabled.		

DB82 **DBX42.0** Data Block	tool_m_function.function_1_on **Tool spec. Function 1 active** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	This signal provides the checkback that tool-specific function 1 is active.		

DB82 **DBX42.1** Data Block	tool_m_function.function_2_on **Tool spec. Function 2 active** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	This signal provides the checkback that tool-specific function 2 is active.		

DB82 **DBX42.2** Data Block	tool_m_function.function_3_on **Tool spec. Function 3 active** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	This signal provides the checkback that tool-specific function 3 is active.		

DB82 **DBX42.3** Data Block	tool_m_function.function_4_on **Tool spec. Function 4 active** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	This signal provides the checkback that tool-specific function 4 is active.		

DB82 **DBX42.4** Data Block	tool_m_function.function_1_activ **Tool spec. Function 1 valid** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	This signal provides the checkback that tool-specific function 1 has been activated or deactivated. The signal is low active.		

DB82 **DBX42.5** Data Block	tool_m_function.function_2_activ **Tool spec. Function 2 valid** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	This signal provides the checkback that tool-specific function 2 has been activated or deactivated. The signal is low active.		

DB82 **DBX42.6** Data Block	tool_m_function.function_3_activ **Tool spec. Function 3 valid** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	This signal provides the checkback that tool-specific function 3 has been activated or deactivated. The signal is low active.		

DB82 **DBX42.7** Data Block	tool_m_function.function_4_activ **Tool spec. Function 4 valid** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	This signal provides the checkback that tool-specific function 4 has been activated or deactivated. The signal is low active.		

DB82 **DBW44** Data Block	mask_number **Current screen number of ShopMill** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 6.2	

DB82	mask_number
Significance of signal	The signal outputs the display number of the current ShopMill display. The following display numbers can be output: **No. ShopMill display** Mode Machine Manual: 19 Main screen 2 T,S,M... 21 Set basic work offset* 30 Workpiece zero 5 Workpiece zero – Set up edge 7 /User form* 31 Workpiece zero – Align edge/User form* 32 Workpiece zero – Distance 2 edges/User form* 33 Workpiece zero – Right-angled corner 8 Workpiece zero – Any corner/User form* 34 Workpiece zero – Rectangular pocket 9 Workpiece zero – 1 Drill-hole/User form* 35 Workpiece zero – 2 drill-holes 36 Workpiece zero – 3 drill-holes 37 Workpiece zero – 4 drill-holes 38 Workpiece zero – Rectangular spigot 10 Workpiece zero – 1 circular spigot/User form* 39 Workpiece zero – 2 circular spigots 40 Workpiece zero – 3 circular spigots 41 Workpiece zero – 4 circular spigots 42 Workpiece zero – Set up plane 11 Workpiece zero – Calibrate probe – Length/User form* 12 Workpiece zero – Calibrate probe – Radius 50 Measure tool 16 Measure tool – Length manual /User form* 17 Measure tool – Diameter manual/User form* 13 Measure tool – Length auto*/User form* 14 Measure tool – Diameter auto*/User form* 51 Measure tool – User form* 15 Measure tool – Calibrate probe/User form* 52 Measure tool – Calibrate fixed point/User form* 60 Swivel 4 Position 18 Face milling 3 Face milling – Apply with OK 1 ShopMill Settings 90 /User form* 91 /Apply display of the user form* Mode MDA: 20 MDA Mode machine auto: 200 Main screen 210 Program control 220 Block search 230 User form* 241 Simultaneous recording – Settings* 242 Simultaneous recording – Top view* 243 Simultaneous recording – 3-plane view* 244 Simultaneous recording – Volume model* 250 Extended softkey bar – Setting Operating area program manager: 300 Directory NC 310 User directory 1* 320 User directory 2* 330 User directory 3* 340 User directory 4* 310 Part programs* 320 Subroutines* 330 User directory 1* 340 User directory 2* 350 User directory 3* 360 User directory 4*

DB82 **DBW44** Data Block	mask_number **Current screen number of ShopMill** Signal(s) from ShopMill
Significance of signal	Operating area program: 400 Work plan/G code editor 411 Simulation – Settings* 412 Simulation – Top view* 413 Simulation – 3-plane view* 414 Simulation – Volume model* Operating area messages/alarms: 500 Messages 510 User form* 520 User form* Operating area tools/zero offsets: 600 Tool list 610 Tool wear 620 User tool list* 630 Magazine 640 Zero offset 650 R parameter 660 User form* 680 User data Run screen 910 Run screen in operating area machine manual 920 Run screen in operating area machine MDA 930 Run screen in operating area machine auto * = If display available

6.3.3 Description of diagnostics buffer signals

DB82 **DBX60.0** Data Block	nck_signal_monitor.monitor_on **Activate diagnostics function (input signal)** Signal(s) to ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	The diagnostics function is updated		

DB82 **DBX60.1** Data Block	nck_signal_monitor.monitor_initialize **Initialize diagnostics function (input signal)** Signal(s) to ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	The circular buffer for the diagnostics function is cleared.		

DB82 **DBW n+0** Data Block	nck_signal_monitor.access_error[m].current_number **Consecutive no. of error message m (output signal)** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	Consecutive no. of error message m		

DB82 **DBB n+2** Data Block	nck_signal_monitor.access_error[m].db_number **DB number of error message m (output signal)** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	DB number of error message m		

DB82 **DBB n+3** Data Block	nck_signal_monitor.access_error[m].byte_number **Byte number of error message m (output signal)** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	Byte number of error message m		

DB82 **DBB n+4** Data Block	nck_signal_monitor.access_error[m].bit_number **Bit number of error message m (output signal)** Signal(s) from ShopMill		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid from software Version: ShopMill 4.3	
Significance of signal	Bit number of error message m		

Comment

Start address for ring buffer entries:

1st entry: n= 62
2nd entry: n= 68
3rd entry: n= 74
.
.
.
19th entry: n= 170
20th entry: n= 176

Number of error message:
m= 1...20

■

Notes

Machine Data

7

7.1 NC machine data for ShopMill

For installation and startup of the NC (see Subsection 4.2.4 “NC Installation and Start-Up”) a machine data record CMM.8x0 is provided containing all relevant NC machine data (including tool management) together with the values to be set. You will find the machine data record on the software CD in the tools\md directory.

You must set NC machine data with exact values as specified. You can adapt NC machine data with minimum and variable values to the specific features of your machine.

Note

Remember that the machine data record also contains machine data for configuring the memory.

The machine data for calibrating the probe (measuring cycles) can be found in Subsection 9.1.5 “Machine data measuring cycles”.

A more detailed description of all NC machine data can be found in:

References: /LIS/, Lists
/IAC/, Installation and Start-Up Guide 810D
/IAD/, Installation and Start-Up Guide 840D
/FB/, Description of Functions
/HBI/, 840Di Manual

NCU load

The load placed on the NCU by the position controller and the interpolator must not exceed a maximum value of 70%. You can set the load in the NC machine data. To do that, proceed as follows:

- Change to the CNC-ISO operator interface and select the “Diagnosis” → “Service display” → “System resources” menu.
- Press “Start” softkey.
  The maximum value for “NCU load by position controller and interpolator” is cleared.
- Change to the ShopMill operator interface and in automatic operating mode select the “Simultaneous recording” function.

- Start the following test program:

```
G0 G91
LABEL:
X1
Y1
Z1
X-1
Y-1
Z-1
GOTOB LABEL
M30
```

- Change back to the CNC-ISO operator interface and select the “Diagnosis” → “Service display” → “System resources” menu.
- If the maximum value for “NCU load by position controller and interpolator” is greater than 70%, adapt the interpolator cycle in MD 10070 $MN_IPO_SYSCLOCK_TIME_RATIO or the position controller cycle in MD 10050 $MN_SYSCLOCK_CYCLE_TIME. Adapting the interpolator cycle has the advantage that axis optimization is not modified.
  With the SINUMERIK 810D you can also set the interpolation task to communication task ratio via MD 10072 $MN_COM_IPO_TIME_RATIO. This value should be ≤ 0.5.
- Repeat the steps described.

7.2 Display machine data for ShopMill

Once you have completed the installation of ShopMill on the PCU and start-up of the NC and the PLC you must adapt the display machine data.
Always check the settings for the display machine data which are marked with "*" in Table 7-1.

7.2.1 Overview of machine data display

Table 7-1 Display machine data for ShopMill

MD number	MD identifier	Comment	Preset default
9014	$MM_USE_CHANNEL_DISPLAY_DATA	Use channel-specific display machine data	0
9020	$MM_TECHNOLOGY	Basic configuration turning/milling	2
9021*	$MM_LAYOUT_MODE	Design of the operator interface	0
9422	$MM_MA_PRESET_MODE	Preset/basic offset in JOG	1
9426	$MM_MA_AX_DRIVELOAD_FROM_PLC1	Machine index of an analog spindle for the drive load display	0
9427	$MM_MA_AX_DRIVELOAD_FROM_PLC2	Machine index of an analog spindle for the drive load display	0
9428	$MM_MA_SPIND_MAX_POWER	Factor for display of spindle utilization	100
9429	$MM_MA_SPIND_POWER_RANGE	Display area for spindle utilization	100
9450	$MM_WRITE_TOA_FINE_LIMIT	Limit value for wear fine	0.999
9451	$MM_WRITE_ZOA_FINE_LIMIT	Limit value for fine adjustment	0.999
9460	$MM_PROGRAM_SETTINGS	Settings in the Program area	H8
9478*	$MM_TO_OPTION_MASK	Settings for ShopMill	1
9479*	$MM_TO_MAG_PLACE_DISTANCE	Distance between individual toolholders	0
9480	$MM_MA_SIMULATION_MODE	Switch fast view on/off	–1
9481	$MM_MA_STAND_SIMULATION_LIMIT	Limit of the standard simulation in KB	200
9602	$MM_CTM_SIMULATION_DEF_VIS_AREA	Simulation of default display area	100
9603	$MM_CTM_SIMULATION_MAX_X	Simulation of maximum display X	0
9604	$MM_CTM_SIMULATION_MAX_Y	Simulation of maximum display Y	0
9605	$MM_CTM_SIMULATION_MAX_VIS_AREA	Simulation of maximum display area	1000
9626	$MM_CTM_TRACE	Settings in ShopMill	0
9639	$MM_CTM_MAX_TOOL_WEAR	Upper input limit for tool wear	1
9640	$MM_CTM_ENABLE_CALC_THREAD_PITCH	Calculation of thread depth, if pitch entered	0
9646	$MM_CTM_FACTOR_O_CALC_THR_PITCH	Factor for calculating the external thread depth if pitch entered	0.6134
9647	$MM_CTM_FACTOR_I_CALC_THR_PITCH	Factor for calculating the internal thread depth if pitch entered	0.5413
9650*	$MM_CMM_POS_COORDINATE_SYSTEM	Position of coordinate system	0
9651*	$MM_CMM_TOOL_MANAGEMENT	Tool management variant	4
9652*	$MM_CMM_TOOL_LIFE_CONTROL	Tool monitoring	1
9653*	$MM_CMM_ENABLE_A_AXIS	Enable 4th axis for operator interface	0
9654	$MM_CMM_SPEED_FIELD_DISPLAY_RES	Number of decimal places in the speed input field	0
9655	$MM_CMM_CYC_PECKING_DIST	Retraction distance for deep hole drilling	–1
9656	$MM_CMM_CYC_DRILL_RELEASE_DIST	Retraction distance for boring	–1
9657	$MM_CMM_CYC_MIN_CONT_PO_TO_RAD	Indication of variation of the smallest possible cutter radius in %	5

MD number	MD identifier	Comment	Preset default
9658	$MM_CMM_CYC_MAX_CONT_PO_TO_RAD	Indication of variation of the largest possible cutter radius	0.01
9659	$MM_CMM_CYC_DRILL_RELEASE_ANGLE	Tool orientation angle on retraction	–1
9660*	$MM_CMM_ENABLE_PLANE_CHANGE	Changing to machining plane (G17, G18, G19)	1
9661*	$MM_CMM_ENABLE_CUSTOMER_M_CODES	Number of input fields for tool-specific functions	0
9662*	$MM_CMM_COUNT_GEAR_STEPS	Number of gear steps	1
9663	$MM_CMM_TOOL_DISPLAY_IN_DIAM	Display radius/diameter for tool	1
9664	$MM_CMM_MAX_INP_FEED_P_MIN	Max. feed in mm/min	10000.0
9665	$MM_CMM_MAX_INP_FEED_P_ROT	Max. feed in mm/rev	1.0
9666	$MM_CMM_MAX_INP_FEED_P_TOOTH	Max. feed in mm/tooth	1.0
9667*	$MM_CMM_FOLLOW_ON_TOOL_ACTIVE	Tool preselection active	1
9668*	$MM_CMM_M_CODE_COOLANT_I_AND_II	M function coolant I and II	–1
9669	$MM_CMM_FACE_MILL_EFF_TOOL_DIAM	Effective cutter diameter for face milling	85.0
9670	$MM_CMM_START_RAD_CONTOUR_POCKET	Radius of approach circle for finishing cut on contour pockets plus half the final machining allowance (–1 = safety clearance)	–1.0
9671	$MM_CMM_TOOL_LOAD_DEFAULT_MAG	Load tool in default magazine	0
9672*	$MM_CMM_FIXED_TOOL_PLACE	Fixed location coding	0
9673*	$MM_CMM_TOOL_LOAD_STATION	Number of loading point	1
9674	$MM_CMM_ENABLE_TOOL_MAGAZINE	Display of magazine list	1
9675	$MM_CMM_CUSTOMER_START_PICTURE	Customized boot screen	0
9676*	$MM_CMM_DIRECTORY_SOFTKEY_PATH1	Path for drive names in directory management	–
9677*	$MM_CMM_DIRECTORY_SOFTKEY_PATH2	Path for drive names in directory management	–
9678*	$MM_CMM_DIRECTORY_SOFTKEY_PATH3	Path for drive names in directory management	–
9679*	$MM_CMM_DIRECTORY_SOFTKEY_PATH4	Path for drive names in directory management	–
9680*	$MM_CMM_M_CODE_COOLANT_I	M function coolant I	8
9681*	$MM_CMM_M_CODE_COOLANT_II	M function coolant II	7
9682	$MM_CMM_CYC_BGF_BORE_DIST	Preboring depth for drill and thread milling	1
9684*	$MM_CMM_M_CODE_TOOL_BITS_1	1. extended M function for tool-specific functions	100
9685*	$MM_CMM_M_CODE_TOOL_BITS_2	2. extended M function for tool-specific functions	101
9686*	$MM_CMM_M_CODE_COOLANT_OFF	M function for coolant off	9
9687	$MM_CMM_TOOL_MOVE_DEFAULT_MAG	Reload tool in default magazine	0
9703*	$MM_CMM_INDEX_AXIS_4	Axis index for 4th axis	0
9704*	$MM_CMM_INDEX_AXIS_5	Axis index for 5th axis	0
9705*	$MM_CMM_INDEX_SPINDLE	Axis index for spindle	4
9706	$MM_CMM_GEOAX_ASSIGN_AXIS_4	Assignment of 4th axis to geometry axis	0
9707	$MM_CMM_IGEOAX_ASSIGN_AXIS_5	Assignment of 5th axis to geometry axis	0
9718*	$MM_CMM_OPTION_MASK_2	Settings for ShopMill	0
9719*	$MM_CMM_OPTION_MASK	Settings for ShopMill	H5
9720*	$MM_CMM_ENABLE_B_AXIS	Enable 5th axis for operator interface	0
9721*	$MM_CMM_ENABLE_TRACYL	Enable signal for cylinder surface transformation	0
9723*	$MM_CMM_ENABLE_SWIVELING_HEAD	Enable swiveling	0
9724	$MM_CMM_CIRCLE_RAPID_FEED	Rapid traverse feed for positioning on circular path	5000
9725	$MM_CMM_ENABLE_QUICK_M_CODES	Enable fast M functions	0
9727	$MM_CMM_ENABLE_POS_A_B_AXIS	Enable support for A/B axis	0

MD number	MD identifier	Comment	Preset default
9728	$MM_CMM_DISPL_DIR_A_B_AXIS_INV	Adapting to the direction of rotation of the A/B axis	0
9729	$MM_CMM_G_CODE_TOOL_CHANGE_PROG	Program name for tool change in the G code	–
9747	$MM_CMM_ENABLE_MEAS_AUTO	Enable automatic workpiece measurement	1
9748	$MM_CMM_MKS_POSITION_MAN_MEAS	Position man. tool measurement with fixed point	0
9749*	$MM_CMM_ENABLE_MEAS_T_AUTO	Enable automatic tool measurement	1
9750*	$MM_CMM_MEAS_PROBE_INPUT	Measuring input for workpiece probe	0
9751*	$MM_CMM_MEAS_T_PROBE_INPUT	Measuring input for tool probe	1
9752	$MM_CMM_MEASURING_DISTANCE	Max. measurement distance for workpiece measurement in the program	5
9753	$MM_CMM_MEAS_DIST_MAN	Max. measurement distance of the workpiece measurement in manual mode	10
9754	$MM_CMM_MEAS_DIST_TOOL_LENGTH	Max. measurement distance for tool length for rotating Spindle	2
9755	$MM_CMM_MEAS_DIST_TOOL_RADIUS	Max. measurement distance for tool radius for rotating. Spindle	1
9756	$MM_CMM_MEASURING_FEED	Measuring feed rate for workpiece measurement	300
9757	$MM_CMM_FEED_WITH_COLL_CTRL	Plane feed with collision monitoring	1000
9758	$MM_CMM_POS_FEED_WITH_COLL_CTRL	Infeed with collision monitoring	1000
9759	$MM_CMM_MAX_CIRC_SPEED_ROT_SP	Max. circumferential speed for tool measurement for rotating Spindle	100
9760	$MM_CMM_SPIND_SPEED_ROT_SP	Max. speed for tool measurement for rotating Spindle	1000
9761	$MM_CMM_MIN_FEED_ROT_SP	Min. feed rate for workpiece measurement for rotating Spindle	10
9762	$MM_CMM_MEAS_TOL_ROT_SP	Measuring accuracy. of tool measurement for rotating. Spindle	0.01
9763*	$MM_CMM_TOOL_PROBE_TYPE	Tool probe type	0
9764*	$MM_CMM_TOOL_PROBE_ALLOWS_AXIS	Permissible axis directions of tool probe	133
9765*	$MM_CMM_T_PROBE_DIAM_LENGTH_MEA	Diameter tool probe length measurement	0
9766*	$MM_CMM_T_PROBE_DIAM_RAD_MEAS	Diameter tool probe radius measurement	0
9767*	$MM_CMM_T_PROBE_DIST_RAD_MEAS	Infeed tool probe upper edge for radius measurement	0
9768*	$MM_CMM_T_PROBE_APPROACH_DIR	Plane approach direction for tool probe	–1
9769	$MM_CMM_FEED_FACTOR_1_ROT_SP	Feed rate factor 1 tool measurement for rotating. sp.	10
9770	$MM_CMM_FEED_FACTOR_2_ROT_SP	Feed rate factor 2 tool measurement for rotating. sp.	0
9771	$MM_CMM_MAX_FEED_ROT_SP	Max. feed for tool for measuring rotating Spindle	20
9772	$MM_CMM_T_PROBE_MEASURING_DIST	Measurement path for tool measurement with stationary spindle	5
9773	$MM_CMM_T_PROBE_MEASURING_FEED	Feed rate for tool measurement with stationary spindle	300
9774	$MM_CMM_T_PROBE_MANUFACTURER	Tool probe type (manufacturer)	0
9775	$MM_CMM_T_PROBE_OFFSET	Measurement result correction for tool measurement for rotating sp.	0
9776	$MM_CMM_MEAS_SETTINGS	Settings for measuring cycles	0
9777	$MM_CMM_ENABLE_TIME_DISPLAY	Control of the time display	0x7F
9855	$MM_ST_CYCLE_TAP_SETTINGS	Tapping settings	0
9999	$MM_TRACE	Test flags for internal diagnosis	0

7.2.2 Description of display machine data

9014 MD number	$MM_USE_CHANNEL_DISPLAY_DATA Use channel-specific display machine data		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: LONG		Valid as of software Version: ShopMill 6.4	
Meaning:	In this MD you determine whether you want to use channel-specific display. 0 = No channel-specific display 1 = Channel-specific display Note: With ShopMill this must be set to MD = 0.		

9020 MD number	$MM_TECHNOLOGY Basic configuration turning/milling		
Default setting: 2	Minimum input limit: 0	Maximum input limit: 2	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software Version: ShopMill 6.1	
Meaning:	In this MD you determine the basic configuration for the simulation and free contour programming. 0 = No specific configuration 1 = Turning machine configuration 2 = Milling machine configuration		

9021 MD number	$MM_LAYOUT_MODE Design of the operator interface		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software Version: ShopMill 6.3	
Meaning:	In this MD you define the design for the operator interface. 0 = Customized colors and softkeys 1 = Traditional design for the operator interface (like up to ShopMill 6.2)		

9422 MD number	$MM_MA_PRESET_MODE Preset/basic offset in JOG		
Default setting: 1	Minimum input limit: 0	Maximum input limit: 3	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 6.4	
Meaning:	In this MD you define the behavior of the function “Set work offset” in “Machine Manual” mode. ≠ 2: Zero point is saved in the currently active work offset, otherwise it is saved in the basic offset = 2: Zero point is saved in basic offset		

9426 MD number	$MM_MA_AX_DRIVELOAD_FROM_PLC1 Machine index of an analog spindle		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 31	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 6.4	
Meaning:	In this MD, you can enter the machine index of an analog spindle for the drive load display. In the case of tapping, an analog tool spindle with a floating tapholder is assumed.		

9427 MD number	$MM_MA_AX_DRIVELOAD_FROM_PLC2 Machine index of an analog spindle		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 31	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 6.4	
Meaning:	In this MD, you can enter the machine index of an analog spindle for the drive load display. In the case of tapping, an analog tool spindle with a floating tapholder is assumed.		

9428 MD number	$MM_MA_SPIND_MAX_POWER Maximum value of the spindle performance display		
Default setting: 100	Minimum input limit: 100	Maximum input limit: ***	
Changes effective after: POWER ON	Protection level: 3/4	Unit: %	
Data type: WORD		Valid as of software version: ShopMill 6.4	
Meaning:	In this MD, enter the factor by which the supplied spindle utilization will be multiplied.		

9429 MD number	$MM_MA_SPIND_POWER_RANGE Display area for spindle utilization		
Default setting: 100	Minimum input limit: 100	Maximum input limit: ***	
Changes effective after: POWER ON	Protection level: 3/4	Unit: %	
Data type: WORD		Valid as of software version: ShopMill 6.4	
Meaning:	In this MD, you specify the display range of the bar displaying the spindle utilization. Depending on the value entered, the percentage values displayed and the extent of the color areas change. Entered value = 100: Percentage values 0, 80 and 100% are displayed. The colored display changes from green to red as of 80%. Entered value = > 100, e.g. 200: Percentage values 0, 100 and 200% are displayed. The colored display changes from green to red as of 100%.		

9450 MD number	$MM_WRITE_TOA_FINE_LIMIT Limit value for wear fine		
Default setting: 0.999	Minimum input limit: –	Maximum input limit: –	
Changes effective after: IMMEDIATELY	Protection level: 3/4		Unit: mm
Data type: DOUBLE		Valid as of software version: ShopMill 6.3	
Meaning:	With this MD you define the upper incremental limit (limit value for wear fine) for tool wear (length, radius). The incremental upper limit is only effective if the active protection level is greater than the protection level set in MD 9203 USER_CLASS_WRITE_FINE. The absolute upper limit is set in MD 9639 $MM_CTM_MAX_TOOL_WEAR.		

9451 MD number	$MM_WRITE_ZOA_FINE_LIMIT Limit value for fine adjustment		
Default setting: 0.999	Minimum input limit: –	Maximum input limit: –	
Changes effective after: IMMEDIATELY	Protection level: 3/4		Unit: mm
Data type: DOUBLE		Valid as of software version: ShopMill 6.3	
Meaning:	When entering the fine adjustment the difference between the old and new value must not exceed the value specified in this MD.		

9460 MD number	$MM_PROGRAM_SETTINGS Settings in the Program area		
Default setting: H8	Minimum input limit: –	Maximum input limit: –	
Changes effective after: IMMEDIATELY	Protection level: 3/4		Unit: Hex
Data type: LONG		Valid as of software version: ShopMill 6.3	
Meaning:	Bit 0 to 4: Reserved Bit 5: Display hidden lines (;*HD*) in the G code editor Bit 6: Reserved		

9478 MD number	$MM_TO_OPTION_MASK Settings for ShopMill		
Default setting: 1	Minimum input limit: 0000	Maximum input limit: FFFF	
Changes effective after: POWER ON	Protection level: 1		Unit: Hex
Data type: LONG		Valid as of software version: ShopMill 6.3	
Meaning:	Bit 0: Display tool parameters “Number of teeth”, “Spindles”, “Coolant”, and “Tool-specific functions” in tool management. Bit 1: Reserved Bit 2: Display additional list in the tool management Bit 3: Disable creation of new tools directly on a magazine location. Bit 4 to bit 6: Reserved Bit 7: Disable editing of tool parameters if the tools are in the magazine (exception: wear data). Bit 8: Evaluate file TO_MILL.INI for configuration of the tool management user interface. Bit 9: Disable loading/unloading of tools if a program is being executed on the machine. Bit 10: Calculate tool wear entries additively. Bit 11: Reserved Bit 12: Disable load and unload on emerg. stop. Bit 13: Display buffer magazine in the tool management. Bit 14: Reserved Bit 15: Disable load/unload tool to spindle. Bit 16: Reserved Bit 17: Hide “Relocate” in the magazine list. Bit 18: Hide “Positioning” in the magazine list.		

9479 MD number	$MM_TO_MAG_PLACE_DISTANCE Distance between individual toolholders		
Default setting: 0	Minimum input limit: 0.0	Maximum input limit: 10000.0	
Changes effective after: POWER ON	Protection level: 3/4		Unit: mm
Data type: DOUBLE		Valid as of software version: ShopMill 6.3	
Meaning:	This MD defines the distance between toolholders in the graphical display of the tools and magazine locations in the tool management. 0 = The tools and magazine locations are not displayed graphically. Note: If the machine has several magazines with different distances between tool holders, the tools cannot be displayed proportionally for all of the magazines because there is only one setting for the distance.		

9480 MD number	$MM_MA_SIMULATION_MODE Switch fast view on and off		
Default setting: –1	Minimum input limit: –1	Maximum input limit: 2	
Changes effective after: IMMEDIATELY	Protection level: 3/4		Unit: –
Data type: BYTE		Valid as of software version: ShopMill 6.4	
Meaning:	This MD defines whether the fast view will be active. –1 = The ShopMill simulation is displayed. 0 = It is possible to choose between ShopMill simulation and fast view. 1 = The fast view is always displayed. 2 = If a program is smaller than the limit defined in machine data 9481 $MM_STAND_SIMULATION_LIMIT, the ShopMill simulation is called; the fast view is called for larger programs.		

9481 MD number	$MM_MA_STAND_SIMULATION_LIMIT Limit of the standard simulation in KB		
Default setting: 200	Minimum input limit: 200		Maximum input limit: 2000000
Changes effective after: IMMEDIATELY	Protection level: 3/4		Unit: –
Data type: INTEGER			Valid as of software version: ShopMill 6.4
Meaning:	With this MD, you specify the size as of which the program loads the fast view.		

9602 MD number	$MM_CTM_SIMULATION_DEF_VIS_AREA Simulation of default display area		
Default setting: 100	Minimum input limit: –10000		Maximum input limit: 10000
Changes effective after: POWER ON	Protection level: 3/4		Unit: mm
Data type: LONG			Valid as of software version: ShopMill 4.3
Meaning:	This MD defines the size of the display area above the X coordinate. The Y coordinate is calculated automatically from this setting.		

9603 MD number	$MM_CTM_SIMULATION_MAX_X Simulation of maximum display X		
Default setting: 0	Minimum input limit: –10000		Maximum input limit: 10000
Changes effective after: POWER ON	Protection level: 3/4		Unit: mm
Data type: LONG			Valid as of software version: ShopMill 4.3
Meaning:	Reserved		

9604 MD number	$MM_CTM_SIMULATION_MAX_Y Simulation of maximum display Y		
Default setting: 0	Minimum input limit: –10000		Maximum input limit: 10000
Changes effective after: POWER ON	Protection level: 3/4		Unit: mm
Data type: LONG			Valid as of software version: ShopMill 4.3
Meaning:	Reserved		

9605 MD number	$MM_CTM_SIMULATION_MAX_VIS_AREA Simulation of maximum display area		
Default setting: 1000	Minimum input limit: –10000		Maximum input limit: 10000
Changes effective after: POWER ON	Protection level: 3/4		Unit: mm
Data type: LONG			Valid as of software version: ShopMill 4.3
Meaning:	This machine data defines the second display area above the X coordinate. The Y coordinate is calculated automatically from this setting.		

9626 MD number	$MM_CTM_TRACE Settings in ShopMill		
Default setting: 0	Minimum input limit: 0000	Maximum input limit: FFFF	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: Hex	
Data type: WORD		Valid as of software version: ShopMill 6.3	
Meaning:	Bit 0: Display ShopMill version ".../xy" in boot screen. Bit 1: Display system messages from ShopMill in the dialog line (for diagnostics purposes only). Bit 2 to bit 12: Reserved Bit 13: Display processing tine for ShopMill between the 1st and 2nd vertical softkey (for diagnostics purposes only). Bit 14: Reserved		

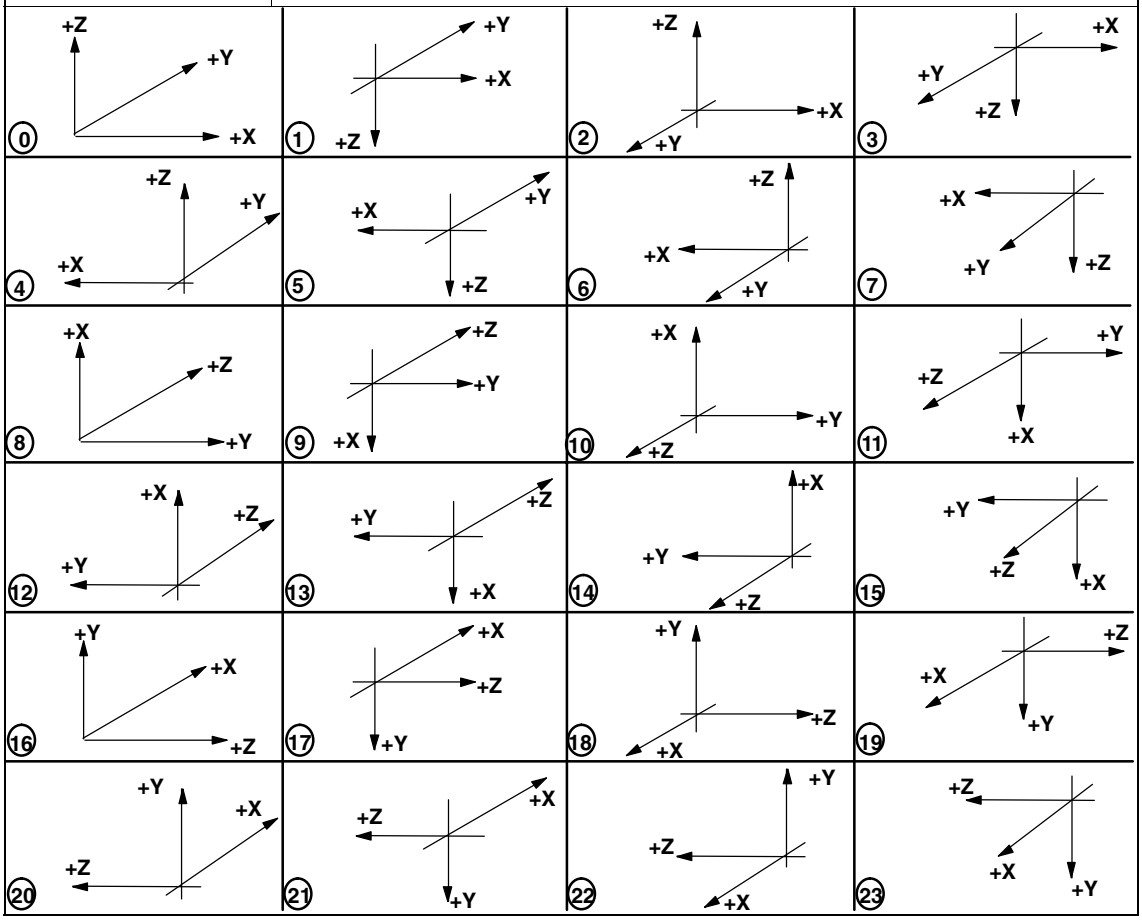
9639 MD number	$MM_CTM_MAX_TOOL_WEAR Upper input limit for tool wear		
Default setting: 1	Minimum input limit: 0	Maximum input limit: 10	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: mm	
Data type: DOUBLE		Valid as of software Version: ShopMill 6.3	
Meaning:	With this MD you define the upper absolute limit for tool wear (length, radius). This means that the total value must not exceed the upper absolute limit when entering the wear value in the tool wear list. The incremental upper limit is defined in MD 9450 $MM_WRITE_TOA_FINE_LIMIT.		

9640 MD number	$MM_CTM_ENABLE_CALC_THREAD_PITCH Calculation of thread depth, if pitch entered		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software Version: ShopMill 6.4	
Meaning:	This MD is for calculating thread depth K for a metric thread according to pitch P (mm/rev) and thread type (external/internal thread). 0 = Thread depth K is not calculated 1 = Thread depth is calculated.		

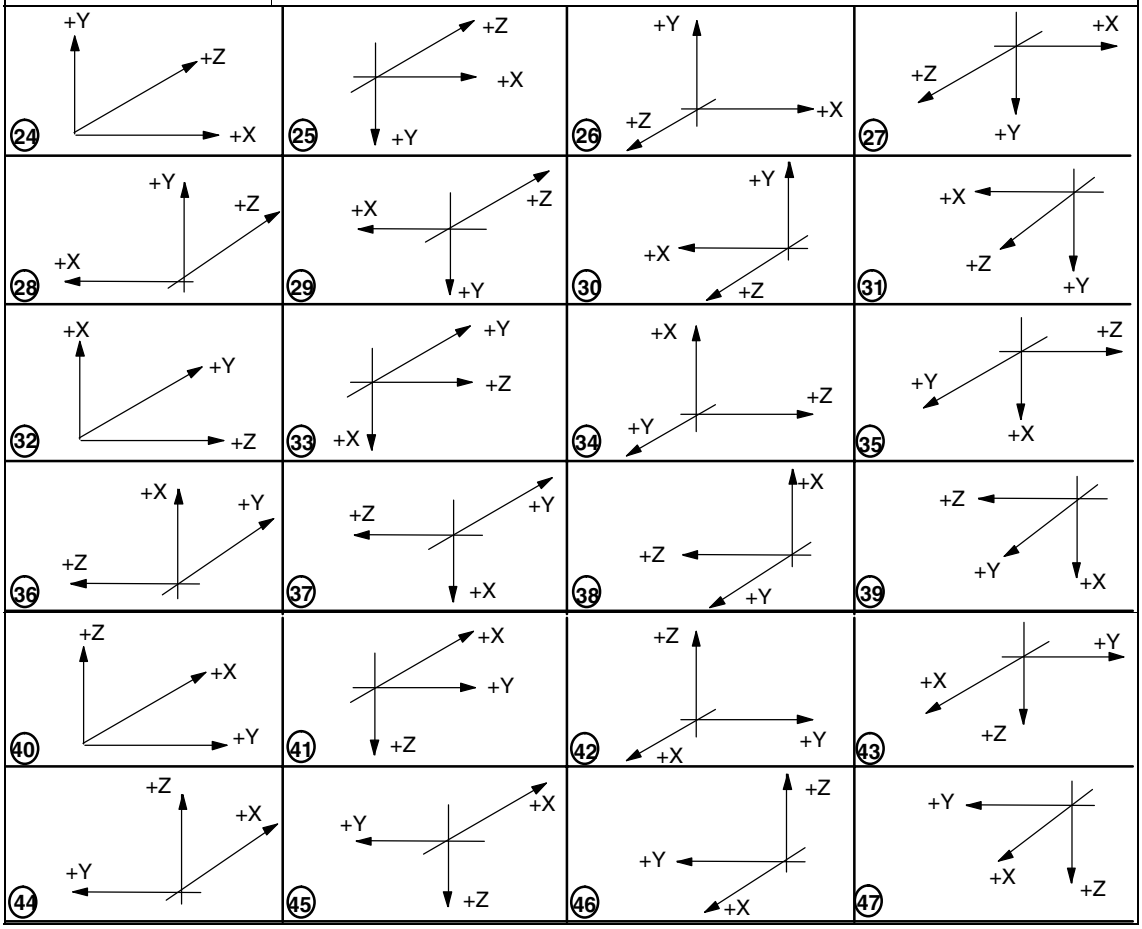
9646 MD number	$MM_CTM_FACTOR_O_CALC_THR_PITCH Factor for calculating the external thread depth if pitch entered		
Default setting: 0,6134	Minimum input limit: –	Maximum input limit: –	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: DOUBLE		Valid as of software Version: ShopMill 6.4	
Meaning:	The factor for converting thread pitch to thread depth for metric external threads is defined in this MD.		

9647 MD number	$MM_CTM_FACTOR_I_CALC_THR_PITCH Factor for calculating the internal thread depth if pitch entered		
Default setting: 0,5413	Minimum input limit: –	Maximum input limit: –	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: DOUBLE		Valid as of software Version: ShopMill 6.4	
Meaning:	The factor for converting thread pitch to thread depth for metric internal threads is defined in this MD.		

9650 MD number	$MM_CMM_POS_COORDINATE_SYSTEM Position of coordinate system		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 47	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 4.3	
Meaning:	You can use this MD to match the coordinate system of the operator interface to that of the machine. In the ShopMill user interface all help screens, sequence graphs, simulation and input fields with circle direction indication change automatically according to the selected position. The coordinate system can assume the positions listed below. Please also refer to MD 9719 $MM_CMM_OPTION_MASK, bit 31.		



9650 MD number	$MM_CMM_POS_COORDINATE_SYSTEM Position of coordinate system



9651 MD number	$MM_CMM_TOOL_MANAGEMENT Tool management variant		
Default setting: 2	Minimum input limit: 1	Maximum input limit: 4	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 4.3	
Meaning:	Selection from two tool management variants: 2: Tool management with loading/unloading 4: Tool management with loading/ unloading		

9652 MD number	$MM_CMM_TOOL_LIFE_CONTROL Tool monitoring		
Default setting: 1	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 4.3	
Meaning:	This MD activates tool monitoring. 0 = Tool monitoring is not displayed 1 = Tool monitoring is displayed		

9653 MD number	$MM_CMM_ENABLE_A_AXIS Enable 4th axis for operator interface		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 3	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 4.3	
Meaning:	4. Enable 4th axis (e.g. A axis) for operator interface: 0 = 4th axis is not displayed on the operator interface 1 = 4th axis is displayed on the operator interface 2 = 4th axis is displayed on the operator interface and can be programmed 3 = 4th axis is displayed on the operator interface only for reference point approach		

9654 MD number	$MM_CMM_SPEED_FIELD_DISPLAY_RES Number of decimal places in the speed input field		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 4	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 4.3	
Meaning:	This MD is for defining the number of decimal places in parameter field S (speed).		

9655 MD number	$MM_CMM_CYC_PECKING_DIST Retraction distance for deep hole drilling		
Default setting: –1	Minimum input limit: –1	Maximum input limit: 100.0	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: mm	
Data type: DOUBLE		Valid as of software version: ShopMill 4.3	
Meaning:	This MD determines the retraction distance for deep-hole drilling with chipbreaking. Note: –1 means that the value for the retraction distance can be entered on the user interface (parameter “V2”, retraction distance).		

9656 MD number	$MM_CMM_CYC_DRILL_RELEASE_DIST Retraction distance for boring		
Default setting: –1	Minimum input limit: –1	Maximum input limit: 10.0	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: mm	
Data type: DOUBLE		Valid as of software version: ShopMill 4.3	
Meaning:	This MD determines the distance by which the tool retracts in the X and Z directions during boring. Note: –1 means that the value of the retraction distance D can be entered on the user interface.		

9657 MD number	$MM_CMM_CYC_MIN_CONT_PO_TO_RAD Indication of variation of the smallest possible cutter radius in %		
Default setting: 5	Minimum input limit: 0	Maximum input limit: 50	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: %	
Data type: WORD		Valid as of software version: ShopMill 4.3	
Meaning:	This MD is required for contour pocket milling. This parameter is for defining by which percentage the radius of a cutter used may be smaller than the one which was used for generating.		

9658 MD number	$MM_CMM_CYC_MAX_CONT_PO_TO_RAD Indication of variation of the greatest possible cutter radius		
Default setting: 0.01	Minimum input limit: 0.0	Maximum input limit: 10.0	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: mm	
Data type: DOUBLE		Valid as of software version: ShopMill 4.3	
Meaning:	This MD is required for contour pocket milling. This parameter is for defining by which amount the radius of a cutter used may be greater than the one which was used for generating.		

9659 MD number	$MM_CMM_CYC_DRILL_RELEASE_ANGLE Tool orientation angle on retraction		
Default setting: –1	Minimum input limit: –1	Maximum input limit: 360	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: Degrees	
Data type: DOUBLE		Valid as of software version: ShopMill 4.3	
Meaning:	This MD determines at which spindle position (0...360^0) the tool, e.g. boring bar, will stop in a hole. Note: –1 means the value for the tool orientation angle can be entered on the user interface.		

9660 MD number	$MM_CMM_ENABLE_PLANE_CHANGE Changing to machining plane (G17, G18, G19)		
Default setting: 1	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 4.3	
Meaning:	Enable change to machining plane (G17, G18, G19): 0 = Change to machining plane (G17, G18, G19) not possible 1 = Changing to machining plane (G17, G18, G19) possible		

9661 MD number	$MM_CMM_ENABLE_CUSTOMER_M_CODES Number of input fields for tool-specific functions		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 4	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 4.3	
Meaning:	This MD activates the number of input fields for tool-specific functions: 0 = No display fields for tool-specific functions 1 = 1 field for one tool-specific function is displayed 2 = 2 fields for 2 tool-specific functions are displayed 3 = 3 fields for 3 tool-specific functions are displayed 4 = 4 fields for 4 tool-specific functions are displayed		

9662 MD number	$MM_CMM_COUNT_GEAR_STEPS Number of gear steps		
Default setting: 1	Minimum input limit: 0	Maximum input limit: 5	
Changes effective after: IMMEDIATELY	Protection level: 3/4		Unit: –
Data type: BYTE		Valid as of software version: ShopMill 4.3	
Meaning:	This MD is for setting the number of gear steps (0 to 5) for the spindle. The possibility of input in the operator interface is thus restricted.		

9663 MD number	$MM_CMM_TOOL_DISPLAY_IN_DIAM Display radius/diameter for tool		
Default setting: 1	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: POWER ON	Protection level: 3/4		Unit: –
Data type: BYTE		Valid as of software version: ShopMill 4.3	
Meaning:	This MD defines how the tool is displayed or is to be input: 0 = Radius 1 = Diameter		

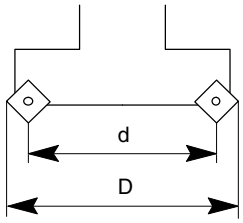
9664 MD number	$MM_CMM_MAX_INP_FEED_P_MIN Max. feed in mm/min		
Default setting: 10000.0	Minimum input limit: 0.0	Maximum input limit: 100000.0	
Changes effective after: IMMEDIATELY	Protection level: 3/4		Unit: mm/min
Data type: DOUBLE		Valid as of software version: ShopMill 4.3	
Meaning:	This MD is for entering the upper feedrate input limit for mm/min.		

9665 MD number	$MM_CMM_MAX_INP_FEED_P_ROT Max. feed in mm/rev		
Default setting: 1.0	Minimum input limit: 0.0	Maximum input limit: 10.0	
Changes effective after: IMMEDIATELY	Protection level: 3/4		Unit: mm/rev
Data type: DOUBLE		Valid as of software version: ShopMill 4.3	
Meaning:	This MD is for entering the upper feed rate input limit for mm/rev.		

9666 MD number	$MM_CMM_MAX_INP_FEED_P_TOOTH Max. feed in mm/tooth		
Default setting: 1.0	Minimum input limit: 0.0	Maximum input limit: 5.0	
Changes effective after: IMMEDIATELY	Protection level: 3/4		Unit: mm/tooth
Data type: DOUBLE		Valid as of software version: ShopMill 4.3	
Meaning:	This MD is for entering the upper feed rate input limit for mm/tooth.		

9667 MD number	$MM_CMM_FOLLOW_ON_TOOL_ACTIVE Tool preselection active		
Default setting: 1	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 4.3	
Meaning:	This MD defines whether a tool preselection is active in a magazine (e.g. chain magazine), i.e. the following tool is already brought to the load station for a pending tool change. 0 = Tool is not active 1 = Tool is active		

9668 MD number	$MM_CMM_M_CODE_COOLANT_I_AND_II M function coolant I and II		
Default setting: –1	Minimum input limit: –1	Maximum input limit: 32767	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: WORD		Valid as of software version: ShopMill 4.4	
Meaning:	This machine data allows you to specify the M function assigned to the simultaneous selection of coolant I and II. Value: –1 = No M function xy = M function xy for coolant I and II		

9669 MD number	$MM_CMM_FACE_MILL_EFF_TOOL_DIAM Effective cutter diameter for face milling		
Default setting: 85.0	Minimum input limit: 50.0	Maximum input limit: 100.0	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: %	
Data type: DOUBLE		Valid as of software version: ShopMill 4.4	
Meaning:	In this MD, you specify the effective cutter diameter if a tool of type “Cutter” (120) is to be used for plane milling. The effective cutter diameter is derived from the ratio d/D, where d = cut diameter and D = largest cutter diameter.  d = 85 D = 100 Effective milling diameter: d/D = 85/100 = 0.85 –> 85%		

9670 MD number	$MM_CMM_START_RAD_CONTOUR_POCKET Radius of approach circle for finishing cut on contour pockets plus half the final machining allowance (–1 = safety clearance)		
Default setting: –1	Minimum input limit: –1	Maximum input limit: 100.0	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: mm	
Data type: DOUBLE		Valid as of software version: ShopMill 4.4	
Meaning:	This MD affects the radius of the approach circle when finishing contour pockets. –1 = The radius is selected such that the safety clearance for final machining is observed at the start point. >0 = The radius is selected such that the value of this machine data for final machining allowance is observed at the start point.		

9671 MD number	$MM_CMM_TOOL_LOAD_DEFAULT_MAG Load tool in default magazine		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 30	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 6.3	
Meaning:	In this MD you define the magazine in which ShopMill first searches for an empty location when loading a tool.		

9672 MD number	$MM_CMM_FIXED_TOOL_PLACE Fixed location coding		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 4.4	
Meaning:	This MD defines the state of newly created tools: 0 = Tool with variable location coding in the magazine 1 = Tools with fixed location coding in the magazine		

9673 MD number	$MM_CMM_TOOL_LOAD_STATION Number of loading point		
Default setting: 1	Minimum input limit: 1	Maximum input limit: 2	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 4.4	
Meaning:	This MD allows you to specify the load point for loading and unloading the magazine and the spindle. (The magazine and the spindle are always loaded/unloaded from the same loading point.) 1 = Loading point 1 2 = Loading point 2		

9674 MD number	$MM_CMM_ENABLE_TOOL_MAGAZINE Display of magazine list		
Default setting: 1	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 4.4	
Meaning:	0 = Magazine list is not displayed 1 = Magazine list is displayed		

9675 MD number	$MM_CMM_CUSTOMER_START_PICTURE Customized boot screen		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 5.1	
Meaning:	Custom boot screen is activated if 0 = Siemens custom boot screen 1 = Customized boot screen		

9676 MD number	$MM_CMM_DIRECTORY_SOFTKEY_PATH1 Path for drive names in directory management		
Default setting: –	Minimum input limit: –	Maximum input limit: –	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: STRING (80 characters)		Valid as of software version: ShopMill 5.1	
Meaning:	This MD defines the path for the drive name of the 2nd softkey (horizontal softkey menu) in the directory management with hard disk network link. The softkey is not displayed if a blank string is entered in the display machine data.		

9677 MD number	$MM_CMM_DIRECTORY_SOFTKEY_PATH2 Path for drive names in directory management		
Default setting: –	Minimum input limit: –	Maximum input limit: –	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: STRING (80 characters)		Valid as of software version: ShopMill 5.1	
Meaning:	This MD defines the path for the drive name of the 3rd softkey (horizontal softkey menu) in the directory management with hard disk network link. The softkey is not displayed if a blank string is entered in the display machine data.		

9678 MD number	$MM_CMM_DIRECTORY_SOFTKEY_PATH3 Path for drive names in directory management		
Default setting: –	Minimum input limit: –	Maximum input limit: –	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: STRING (80 characters)		Valid as of software version: ShopMill 5.1	
Meaning:	This MD defines the path for the drive name of the 4th softkey (horizontal softkey menu) in the directory management with hard disk network link. The softkey is not displayed if a blank string is entered in the display machine data.		

9679 MD number	$MM_CMM_DIRECTORY_SOFTKEY_PATH4 Path for drive names in directory management		
Default setting: –	Minimum input limit: –	Maximum input limit: –	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: STRING (80 characters)		Valid as of software version: ShopMill 5.1	
Meaning:	This MD defines the path for the drive name of the 5th softkey (horizontal softkey menu) in the directory management with hard disk network link. The softkey is not displayed if a blank string is entered in the display machine data.		

9680 MD number	$MM_CMM_M_CODE_COOLANT_I M function coolant I		
Default setting: 8	Minimum input limit: 0	Maximum input limit: 32767	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: WORD		Valid as of software version: ShopMill 5.1	
Meaning:	This MD is set to define the M function for coolant I which is output when the tool is changed.		

9681 MD number	$MM_CMM_M_CODE_COOLANT_II M function coolant II		
Default setting: 7	Minimum input limit: 0	Maximum input limit: 32767	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: WORD		Valid as of software version: ShopMill 5.1	
Meaning:	This MD is set to define the M function for coolant II which is output when the tool is changed.		

9682 MD number	$MM_CMM_CYC_BGF_BORE_DIST Preboring depth for drill and thread milling		
Default setting: 1	Minimum input limit: 0	Maximum input limit: 100	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: mm	
Data type: DOUBLE		Valid as of software version: ShopMill 6.2	
Meaning:	This MD defines the preboring depth for drill and thread milling.		

9684 MD number	$MM_CMM_M_CODE_TOOL_BITS_1 1. extended M function for tool-specific functions		
Default setting: 100	Minimum input limit: –1	Maximum input limit: 255	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: LONG		Valid as of software version: ShopMill 6.2	
Meaning:	With this MD you define the 1st extended M function for the tool-specific functions. Please note that the same setting must be made in interface signal DB82.DBB12 ext_m_cmd_1 (see also Chapter 3 “Reserved Functions”). Note: –1 = The tool-specific functions are not assigned to an M function but you can evaluate the tool-specific functions directly from the variables $TC_DP25[x,1], bits 0 to 3.		

9685 MD number	$MM_CMM_M_CODE_TOOL_BITS_2 2. extended M function for tool-specific functions		
Default setting: 101	Minimum input limit: –1	Maximum input limit: 255	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: LONG		Valid as of software version: ShopMill 6.2	
Meaning:	With this MD you define the 2nd extended M function for the tool-specific functions. Please note that the same setting must be made in interface signal DB82.DBB13 ext_m_cmd_2 (see also Chapter 3 “Reserved Functions”). Note: –1 = The tool-specific functions are not assigned to an M function but you can evaluate the tool-specific functions directly from the variables $TC_DP25[x,1], bits 0 to 3.		

9686 MD number	$MM_CMM_M_CODE_COOLANT_OFF M function for coolant off		
Default setting: 9	Minimum input limit: 0	Maximum input limit: 32767	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: LONG		Valid as of software version: ShopMill 6.2	
Meaning:	This MD defines the M function for switching off the coolant which is output when the tool is changed.		

9687 MD number	$MM_CMM_TOOL_MOVE_DEFAULT_MAG Reload tool in default magazine		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 30	
Changes effective after: POWER ON	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 6.3	
Meaning:	In this MD you define the magazine in which ShopMill first searches for an empty location when relocating a tool.		

9703 MD number	$MM_CMM_INDEX_AXIS_4 Axis index for 4th axis		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 127	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: UBYTE		Valid as of software version: ShopMill 5.3	
Meaning:	The number of the channel axis is entered in this MD.		

9704 MD number	$MM_CMM_INDEX_AXIS_5 Axis index for 5th axis		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 127	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: UBYTE		Valid as of software version: ShopMill 5.3	
Meaning:	The number of the channel axis is entered in this MD.		

9705 MD number	$MM_CMM_INDEX_SPINDLE Axis index for spindle		
Default setting: 4	Minimum input limit: 0	Maximum input limit: 127	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: UBYTE		Valid as of software version: ShopMill 5.3	
Meaning:	The number of the channel axis is entered in this MD.		

9706 MD number	$MM_CMM_GEOAX_ASSIGN_AXIS_4 Assignment of 4th axis to geometry axis		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 3	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 6.4	
Meaning:	In this MD, the 4th axis is assigned a geometry axis. Assignment is necessary if you work with the angle offset parameter when measuring a workpiece. 0 = no assignment 1 = 4th axis in direction of 1st geometry axis (X) –> A-axis 2 = 4th axis in direction of 2nd geometry axis (Y) –> B-axis 3 = 4th axis in direction of 3rd geometry axis (Z) –> C-axis		

9707 MD number	$MM_CMM_GEOAX_ASSIGN_AXIS_5 Assignment of 5th axis to geometry axis		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 3	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 6.4	
Meaning:	In this MD, the 5th axis is assigned a geometry axis. Assignment is necessary if you work with the angle offset parameter when measuring a workpiece. 0 = no assignment 1 = 4th axis in direction of 1st geometry axis (X) –> A-axis 2 = 4th axis in direction of 2nd geometry axis (Y) –> B-axis 3 = 4th axis in direction of 3rd geometry axis (Z) –> C-axis		

9718 MD number	$MM_CMM_OPTION_MASK_2 Settings for ShopMill		
Default setting: 0	Minimum input limit: 0000	Maximum input limit: FFFF	
Changes effective after: IMMEDIATELY	Protection level: 1	Unit: Hex	
Data type: LONG		Valid as of software version: ShopMill 6.3	
Meaning:	Bit 0: Do not jump to Automatic mode when an external program (from the PLC) is selected for execution. Bit 1: Influencing the simulation speed with the feedrate override. Bit 2: Do not display or allow input of basic offset in the measurement and program screens. Bit 3 to bit 5: Reserved.		

9719 MD number	$MM_CMM_OPTION_MASK Settings for ShopMill		
Default setting: H5	Minimum input limit: 0000	Maximum input limit: FFFF	
Changes effective after: IMMEDIATELY	Protection level: 1	Unit: Hex	
Data type: LONG		Valid as of software version: ShopMill 6.3	
Meaning:	Bit 0 and bit 1: Reserved Bit 2: Do not automatically delete MDI buffer. Bit 3 to bit 8: Reserved Bit 9: Start program execution in all screens. Bit 10 to bit 17: Reserved Bit 18: When switching from manual/MDI/Auto, change the operating mode but not the ShopMill user interface. Bit 19: Instead of “MCS” and “WCS” display texts “Machine” and “Workpiece”. Bit 20: Display work offsets not as “ZO1”, but as “G54” (except in the work offset list). Bit 21: Enable basic block display. Bit 22 to bit 25: Reserved Bit 26: Enable directory “Part programs” in program manager. Bit 27: Enable directory “Subroutines” in program manager. Bit 28 to bit 30: Reserved Bit 31: Always display coordinate dimension for G17 as follows: X right, Y up (right-handed coordinate system) or down (left-handed coordinate system).		

9720 MD number	$MM_CMM_ENABLE_B_AXIS Enable 5th axis for operator interface		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 3	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 5.1	
Meaning:	5. Enable 5th axis (e.g. B axis) for operator interface: 0 = 5th axis is not displayed on the operator interface 1 = 5th axis is displayed on the operator interface 2 = 5th axis is displayed on the operator interface and can be programmed 3 = 5th axis is displayed on the operator interface only for reference point approach		

9721 MD number	$MM_CMM_ENABLE_TRACYL Enable signal for cylinder surface transformation		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 5.1	
Meaning:	Enable the cylinder surface transformation function on the operator interface: 0 = The cylinder surface transformation function is not displayed on the operator interface. 1 = The cylinder surface transformation function is displayed on the operator interface. The cylinder surface transformation function can only be used if it has been started up in the CNC-ISO operator interface.		

9723 MD number	$MM_CMM_ENABLE_SWIVELING_HEAD Enable swiveling		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 5.1	
Meaning:	Enable the Swiveling function on the operator interface. 0 = The Swiveling function is not displayed on the operator interface 1 = The Swiveling function is displayed in the operator interface Swiveling can only be used if it has been started up in the CNC-ISO operator interface.		

9724 MD number	$MM_CMM_CIRCLE_RAPID_FEED Rapid traverse feed for positioning on circular path		
Default setting: 5000	Minimum input limit: 0	Maximum input limit: 100000	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: mm/min	
Data type: DOUBLE		Valid as of software version: ShopMill 6.2	
Meaning:	Use this MD to set the rapid traverse feed in mm/min for positioning on a circular path.		

9725 MD number	$MM_CMM_ENABLE_QUICK_M_CODES Enable fast M functions		
Default setting: 0	Minimum input limit: –	Maximum input limit: –	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 6.4	
Meaning:	This MD is used to enable fast M functions. This means that the M functions are executed by the PLC without confirmation. Bit 0: Coolant 1 ON Bit 1: Coolant 2 ON Bit 2: Coolant 1 and 2 ON Bit 3: Coolant OFF		

9727 MD number	$MM_CMM_ENABLE_POS_A_B_AXIS Enable support for A/B axis		
Default setting: 0	Minimum input limit: –	Maximum input limit: –	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 6.4	
Meaning:	This MD determines whether the angle of the A/B axis can also be programmed directly for position patterns. 0 = no support for A/B axis for position patterns > 0 = support for A-axis for position patterns, value = number of channel axis < 0 = support for B-axis for position patterns, value = number of channel axis		

9728 MD number	$MM_CMM_DISPL_DIR_A_B_AXIS_INV Adapting to the direction of rotation of the A/B axis		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 6.4	
Meaning:	With this MD, you can adapt the displayed and executed direction of rotation to the start-up of the machine axes. The direction of rotation is viewed in the direction of the positive coordinate axis. 0 = right (per DIN) 1 = left		

9729 MD number	$MM_CMM_G_CODE_TOOL_CHANGE_PROG Program name for tool change in the G code		
Default setting: –	Minimum input limit: –	Maximum input limit: –	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: STRING (24)		Valid as of software version: ShopMill 6.4	
Meaning:	With this MD, you specify the program name of the tool change program. The tool change program is automatically called as soon as you have programmed a tool in the G code via softkey.		

9748 MD number	$MM_CMM_MKS_POSITION_MAN_MEAS Position man. tool measurement with fixed point		
Default setting: 0	Minimum input limit: –	Maximum input limit: –	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: mm	
Data type: DOUBLE		Valid as of software version: ShopMill 6.4	
Meaning:	This MD defines the position of the fixed point in the machine coordinate system if a fixed reference point is to be used for manual tool measurement. Alternately, the position of the fixed point can also be determined via the function “Machine manual” → “Measure tool” → “Calibration fixed point”. The determined position is then automatically entered into this MD.		

9777 MD number	$MM_CMM_ENABLE_TIME_DISPLAY Enable the time display		
Default setting: 0x7F	Minimum input limit: –	Maximum input limit: –	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: BYTE		Valid as of software version: ShopMill 6.4	
Meaning:	With this MD, you can specify the display of the operating times. Bit 0: Program progress display Bit 1: Display time of day Bit 2: Display date Bit 3: Display machine runtime Bit 4: Display machining time Bit 5: Display use of machine Bit 6: Display program repeats		

Note

For a description of the display machine data for measuring cycles, please refer to Subsection 9.1.6 “Display machine data measuring cycles”.

9855 MD number	$MM_ST_CYCLE_TAP_SETTINGS Tapping settings		
Default setting: 0	Minimum input limit: –	Maximum input limit: –	
Changes effective after: IMMEDIATELY	Protection level: 3/4	Unit: –	
Data type: WORD		Valid as of software version: ShopMill 6.3	
Meaning:	Bit 0: exact stop behavior as before cycle call active Bit 1: exact stop G601 Bit 2: exact stop G602 Bit 3: exact stop G603 Bit 4: with/without feed-forward control as before cycle call active Bit 5: with feed-forward control FFWON Bit 6: without feed-forward control FFWOF Bit 8: SOFT/BRISK/DRIVE as before cycle call active Bit 9: with jerk limitation SOFT Bit 10: without jerk limitation BRISK Bit 11: reduced acceleration DRIVE Bit 12: activate spindle operation again with MCALL Bit 13: remain in position control with MCALL		

9999 MD number	$MM_TRACE Test flags for internal diagnosis		
Default setting: 0	Minimum input limit: 0000	Maximum input limit: FFFF	
Changes effective after: POWER ON	Protection level: 1/1	Unit: Hex	
Data type: WORD		Valid as of software version: ShopMill 6.3	
Meaning:	Bit 0: Reserved Bit 1: Display system messages from HMI in the dialog line (for diagnostics purposes only). Bits 2 to 4: Reserved		

■

Tool Management

8

8.1 Overview of functions

Option

ShopMill only runs when the tool management option is set. This is contained within the Shop Mill package. The option is contained in the machine data block for ShopMill.

References: /FBW/, Description of Tool Management Functions

Data

Data storage and management is carried out in the NC. All data can be read and written manually, via initialization program or by data transfer.

Operation

Operation is performed via system screens.

Programming

When using tool management it is possible to call the tool with another name, e.g. “Milling cutter 120mm”.
It is still possible to call the tool via a T No. (tool number). The T No. is then the name of the tool.

PLC

Separate PLC blocks are available for tool management to handle communication between NC and PLC.

Tools

A maximum of 250 tools can be set up on the PCU 20; on the PCU 50, the maximum number of tools is limited by MD 18082 $MN_MM_NUM_TOOL.
Up to 9 cutting edges can be defined per tool.

Replacement tools

A total of 98 replacement tools can be set up for each tool.

Magazine

Chain and disk-type magazines can be managed. The maximum number of magazines is set in the NC.
Display MD 9674 $MM_CMM_ENABLE_TOOL_MAGAZINE can be set to conceal the magazine list.

Location coding

Display MD 9672 $MM_CMM_FIXED_TOOL_PLACE determines whether all tools have a fixed or variable location coding.

- Fixed location coding (MD 9672, value 1) means that the tool is permanently assigned to a magazine location. This concept can be used for machines with disk-type magazine.
- For variable location coding (MD 9672, value 0), a tool with a tool number or tool name can be returned to a different magazine location from its original one. This concept can be used for machines with chain magazine.
  Individual tools can be set to fixed-location coded on the user interface (tool wear).

Magazine location blocking

Magazine locations can be blocked, e.g. for oversized tools occupying adjacent magazine locations.

Monitoring functions

The tool management system includes a tool monitoring function that monitors based on cutting edges either by tool life, tool loading operations or wear. Replacement tools (sister tools) are distinguished by their Duplo No. (DP).
Tool monitoring can be deactivated via the display MD 9652 $MM_CMM_TOOL_LIFE_CONTROL.
You can activate wear monitoring via display MD 18080, bit 5.

Tool management without loading/ unloading

Setting 2 of display MD 9651 $MM_CMM_TOOL_MANAGEMENT can be selected to set the tool management function without a Load/Unload softkey.

Tool management with loading/ unloading

Setting 4 of display MD 9651 $MM_CMM_TOOL_MANAGEMENT can be selected to set the tool management function with the Load/Unload softkey.

Load

Loading brings the tool to its magazine location.

Unload

Unloading removes the tool from the magazine.

Sorting

Tools can be sorted in the tool and tool wear lists according to magazine location, name and type.

Manual tools

Manual tools are tools that are stored in the tool list but not in the magazine. These tools must be attached/detached manually to/from the spindle.

Other functions

- Load/unload point for tools by means of display MD 9673 $MM_CMM_TOOL_LOAD_STATION
- Number of input fields for tool-specific functions by means of display MD 9661 $MM_CMM_ENABLE_CUSTOMER_M_CODES
- Display tools as diameter or radius via display MD 9663 $MM_CMM_TOOL_DISPLAY_IN_DIAM

Changing data

Note

Modifications to the tool and cutting edge data via system variables in the part program are displayed in the tool list on the ShopMill operator interface only if they refer to the tool currently loaded in the spindle.

8.2 Start-up sequence

You can either start up tool management together with ShopMill start-up (see Section 4.2 “Initial Start-up Sequence”) or subsequently.

Proceed as follows to start up tool management:

1. NC start-up
2. PLC installation and start-up
3. Adapt display machine data
4. Create tool-changing cycle

If tool management already exists on your machine it is not necessary to install one especially for ShopMill, i.e. NC, PLC and tool-changing cycles start-up is not necessary, you only need to adapt the display machine data.

A precise description of tool management start-up is provided in:
References /FBIW/, Description of Functions Tool Management

Note

In the case of the PCU 50 you can also perform tool management start-up (generate configuration file and PLC data) on the CNC-ISO operator interface.

References: /FBW/, Description of Tool Management Functions

8.3 Start-up in the NC

Requirements

- PCU start-up is performed and the connection to the NC established.
- NC start-up is carried out with the default machine data.

Execution

- Enter the NC machine data for tool management.
- Create a new configuration file for tool management or use and adapt the examples from the NC Toolbox.
- Load the configuration file in the control.

8.3.1 Enter the NC machine data

For tool management, machine data for memory setting and activation of the management function must be set.

Machine data for memory setting

Memory space must be made available in the battery-backed RAM for tool management.

The following machine data must be set:

MD 18080	Activate the memory for the tool management
MD 18082	Number of tools to be managed by the NCK
MD 18084	Number of magazines that the NCK can manage (min. 3); include intermediate memory and loading magazine in the count!
MD 18086	Number of magazine locations that the NCK can manage; include 3 intermediate memory locations (2 gripper and 1 spindle) and 2 load locations in the count!
MD 18100	Number of cutting edges in the NCK

Note

ShopMill can manage 9 cutting edges per tool.
Define the total number of all available cutting edges in MD 18105 MM_MAX_CUTTING_EDGE_NO.
It is not necessary to enter the number of tools multiplied by 9 cutting edges. Instead, specify approximately how many cutting edges you will need in total.

Example

Assignment of machine data if a dual gripper is used to enable use of manual tools when the magazine is full (30 locations):

18082=40;	40 tools (30 tools for the magazine + 10 tools as manual tools)
18084=3;	1 magazine + 1 buffer magazine + 1 loading magazine
18086=35;	30 magazine locations + 3 buffers + 2 loading locations
18100=80;	80 cutting edges

Note

The machine data settings serve only to reserve memory; locations are not assigned to the magazine, etc. until the configuration file is set up and loaded (see Subsection 8.3.3 “Creating and Loading the Configuration File”).

Modifying the “memory-influencing” machine data reformats the battery-backed RAM. The data must therefore be backed up beforehand.

Machine data for activating tool management

In addition, the following machine data must be set for activation of the tool management:

MD 20310	Channel-specific activation of tool management
MD 20320	Activation of tool life monitoring for the spindle specified here
MD 22550	New tool offset for M function
MD 22560	M function for tool change
MD 22562	Error handling with programmed tool change

Note

Bits 0–3 of MD 20310 $MC_TOOL_MANAGEMENT_MASK and MD 18080 $MN_MM_TOOL_MANAGEMENT_MASK must always be set identically.

Default

The NC machine data for tool management are in machine data record CMM.8X0.

A detailed description of the NC machine data for tool management is given in the next Subsection 8.3.2 “Description of the NC Machine Data for Tool Management”.

8.3.2 Description of NC machine data

18080	**MM_TOOL_MANAGEMENT_MASK**		
MD number	Activate the memory for tool management		
Default setting: 0x0	Minimum input limit: 0	Maximum input limit: 0xFFFF	
Changes effective after: POWER ON	Protection level: 1/4	Unit: HEX	
Data type: DWORD	Applies from SW version: 4.3		
Meaning:	Activation of the tool management memory with “0” means: The set tool management data do not occupy any memory, tool management is not available. Bit 0=1: Memory for tool management specific data is made available, the MDs for reserving memory must be set accordingly (18086 MM_NUM_MAGAZINE_LOCATION, 18084 MM_NUM_MAGAZINE) Bit 1=1: Memory is provided for monitoring data Bit 2=1: Memory is provided for user data (CC data) Bit 3=1: Memory is provided for considering the adjacent location Bit 4=1: Memory and function release for PI service _N_TSEARC = “Complex search for tools in magazine” is initialized. Bit 5=1: Wear monitoring active (SW5 and later, 840D) Bit 6=1: Wear grouping available (SW5 and later, 840D) Bit 7=1: Reserve memory for adapter of magazine locations Bit 8=1: Memory for insert and/or setup compensations Bit 9=1: Tools of a turret no longer vacate their turret location on a tool change (in the display) The coded type of memory reservation enables economic use of memory management for the functionality provided. Example: Standard memory reservation for tool management: MD = 3 (bit 0 + 1=1) means tool management and tool monitoring data are ready MD = 1 means TM without TM monitoring function data		

18082	**MM_NUM_TOOL**		
MD number	Number of tools the NCK can manage		
Default setting: 40	Minimum input limit: 0	Maximum input limit: 600	
Changes effective after: POWER ON	Protection level: 2/4	Unit: —	
Data type: DWORD	Applies from SW version: 2.		
Meaning:	The number of tools which the NCK can manage is entered here. The maximum number of tools corresponds to the number of cutting edges in the NCK. Battery–backed memory is reserved for the number of tools.		
Further references:	Description of Functions: Memory Configuration (S7), Tool Offset (W1)		

18084	MM_NUM_MAGAZINE		
MD number	Number of magazines the NCK can manage		
Default setting: 3	Minimum input limit: 0	Maximum input limit: 32	
Changes effective after: POWER ON	Protection level: 2/4	Unit: —	
Data type: DWORD	Applies from SW version: 2.		
Meaning:	Number of magazines that the NCK can manage (active and background magazines). This MD can be used to reserve battery-backed memory for the magazines. Important: One load magazine and a buffer magazine is set up in the tool management for each TOA unit. These magazines must be taken into account. Value = 0: The tool management cannot be active because no data can be created.		
Further references:	Description of Functions: Memory Configuration (S7)		

18086	MM_NUM_MAGAZINE_LOCATION		
MD number	Number of magazine locations the NCK can manage		
Default setting: 35	Minimum input limit: 0	Maximum input limit: 600	
Changes effective after: POWER ON	Protection level: 2/4	Unit: —	
Data type: DWORD	Applies from SW version: 2.		
Meaning:	Number of magazines the NCK can manage. This MD reserves the battery-backed memory for the magazine locations. Important: The locations in the buffer and a load magazine must be taken into account. Value = 0: Tool management cannot be active because no data can be created.		
Further references:	Description of Functions: Memory Configuration (S7)		

18100	MM_NUM_CUTTING_EDGES_IN_TOA		
MD number	Number of tool cutting edges per TOA block		
Default setting: 80	Minimum input limit: 0	Maximum input limit: 1500	
Changes effective after: POWER ON	Protection level: 2/4	Unit: —	
Data type: DWORD	Applies from SW version: 2.		
Meaning:	The MD specifies the number of tool edges in the NCK. For each tool – irrespective of the tool type – this machine data reserves approximately 250 bytes per TOA block of the battery-backed memory. Tools with cutting edges of type 400–499 (=grinding tools) additionally occupy space for a cutting edge. Example: Define 10 grinding tools each with one cutting edge. Then the following must apply at least: MM_NUM_TOOL = 10 MM_NUM_CUTTING_EDGES_IN_TOA = 20 See also MM_NUM_TOOL Special cases: The buffered data is lost if this machine data is altered! References: /FBW/, “Description of Tool Management Functions”		
Further references:	Description of Functions: Memory Configuration (S7)		

20310 MD number	**TOOL_MANAGEMENT_MASK** Channel-specific activation of tool management		
Default setting: 0x0, ...	Minimum input limit: 0	Maximum input limit: 0xFFFFF	
Changes effective after POWER ON	Protection level: 2/4	Unit: HEX	
Data type: DWORD	Applies from SW version: 2		
Meaning:	MD = 0: Tool management inactive Bit 0=1: Tool management active The tool management functions are enabled for the current channel. Bit 1=1: Tool monitoring function active The functions for monitoring the tools (tool life and workpiece count) are enabled. Bit 2=1: OEM functions active The memory can be used for the user data (see also MD 18090 to 18098). Bit 3=1: Consider adjacent location active **Bit 0 to bit 3** must be set in MD 18080 MM_TOOL_MANAGEMENT_MASK. Bit 4=1: The PLC can request tool change preparation again with modified parameters. **With T selection or M06, the part program pauses until it is acknowledged from the PLC program** Bit 5=1: The main run of the main spindle can be stopped within an OB1 cycle (e.g. by read-in halt) after a tool command has been output. Bit 5=0: The main run of the main spindle is continued after command output to the PLC. Bit 6=1: The main run of the auxiliary spindle can be stopped within an OB1 cycle (e.g. by read-in halt) after a tool command has been output. Bit 6=0: The main run of the main spindle is continued after command output to the PLC. Bit 7=1: The main run of the main spindle is halted until acknowledgement with status 1... is received via FC7, FC8.State 1. Bit 7=0: The main run of the main spindle is continued after command output to the PLC. Bit 8=1: The main run of the secondary spindle is halted until acknowledgement with status 1... is received via FC7, FC8. Bit 8=0: The main run of the auxiliary spindle is continued after command output to the PLC. Bit 9: Reserved 10=1: M06 is delayed until “prepare change” via FC8 (status 1...) from the PLC. The change signal (e.g. M06) is only output once tool selection (DBX [n+0].2) has been acknowledged. The part program is halted with M06 until the tool selection has been acknowledged. Bit 10=0: The tool change ON command is not output from NCK –> PLC until the PLC preparation acknowledgement has been received. This is relevant for PLC command 3 (i.e. programming M06 in a block which does not contain T). Bit 11=1: The preparatory command is output even if it has already been issued once for the same tool. This system is used to position the chain with the first “Tx” call and to check with the second call whether the tool is in the correct tool-change location (e.g. in front of the changing station) Bit 11=0: The preparatory command can be output only once for a tool. Bit 12=1: The preparatory command is also carried out even if the tool is already in the spindle. This means that the T selection signal (DB72.DBXn.2) is set even if it has already been set for the same tool. (Tx...Tx) Bit 12=0: The preparatory command is not executed if the tool is already inserted in the spindle.		

20310 MD number	**TOOL_MANAGEMENT_MASK** Channel-specific activation of tool management
Meaning:	Bit 13=1: Only for systems with sufficient memory capacity. Recording of tool sequences in a diagnostics buffer. On Reset the commands are transferred from the diagnostics buffer to the passive file system (NCATR xx.MPF under partprogram). This file is required by the Hotline. Tool sequences are recorded in the diagnostics buffer only on systems with sufficient memory (NCU572, NCU573). Bit 14=1: An automatic tool change takes place on Reset and Start in accordance with the following machine data MD 20120 TOOL_RESET_NAME MD 20110 RESET_MODE_MASK MD 20124 TOOL_MANAGEMENT_TOOLHOLDER. If the tool specified in TOOL_RESET_NAME is to be loaded (this is set in RESET_MODE_MASK), a tool-change command is output to the application interface on RESET or START (DB72). If RESET_MODE_MASK is set to retain the active tool and if the active tool is disabled in the spindle (by the user), a tool-change command for a replacement tool is output to the application interface. If no replacement tool is available, an error message is output. Bit 14=0: No automatic tool change takes place on RESET and Start. Bit 15=1: The tool is not returned in response to several preparatory commands (Tx–>Tx). This method of function activation permits various combinations. Example for default activation of the tool management: MD 20310 TOOL_MANAGEMENT_MASK = 3 (Bit0 + 1 = 1) Bit16=1: T location number is active Bit 15=0: The tool is not returned. Bit 16=1: T=location number is active. Bit 17=1: Tool life decrementation can be started/stopped via the PLC in channel DB 2.1...DBx 1.3. Bit 18=1: Activation of monitoring “last tool in tool group”. Bit 18=0: No monitoring for “last tool in tool group” Bit 19=1: Activation for bit 5...8 Bit 19=0: Functions described under bits 5...8 are not available. Bit 20=0: The commands generated on PLC signal “program testing active” are not output to the PLC. The NCK acknowledges the commands independently. Magazine and tool data are not changed. Exception: the status of the tool activated in the test area can be changed to “active”. Bit 20=1: The commands generated on PLC signal “program testing active” are output to the PLC. Depending on the type of PLC acknowledgement, tool/magazine data in the NCK can be altered at the same time. If the acknowledgement parameters for the target magazine are set to the same values as the source magazine, the tool is not transported and thus no data modified in the NCK. Exception: the status of the tool activated in the test area can be changed to “active”. Bit 21=0: Ignore tool status “W” on tool selection. Bit 21=1: Tools with status “W” cannot be selected by another tool change or tool preparation command. Bit 22=0 Default setting Bit 22=1 If the function T=“Location” (see Bit 16) is active, the tool groups are automatically divided into subgroups. $TC_TP11 is the grouping or selection parameter. On the transition fro the replacement tool, only those tools of the tool group are recognized as replacement tools that have at least one bit of the tool set at the programmed location in the $TC_TP11 value. Bit 23=0 Default setting The tool management selects the tool with optimal reliability in the main run. I.e. the interpreter has to wait until the end of tool selection for offset selection. Bit 23=1 For simple applications The interpreter selects the tool itself. I.e. no synchronization with the main run is required for offset selection. (If the tool becomes no longer useable after selection but before loading, an uncorrectable alarm may result.)

20320 MD number	TOOL_TIME_MONITOR_MASK Activation of tool life monitoring for the spindle specified here		
Default setting: 1/2	Minimum input limit: 1	Maximum input limit: 4	
Changes effective after: POWER ON	Protection level: 2/4	Unit: —	
Data type: DWORD	Applies from SW version: 2		
Meaning:	Value = 1: Monitoring is carried out for spindle 1. Value = 2: Monitoring is carried out for spindle 1 and spindle 2.		
Further references:	Description of Functions: Memory Configuration (S7)		

22550 MD number	TOOL_CHANGE_MODE New tool offset for M function		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after: POWER ON	Protection level: 2/4	Unit: —	
Data type: BYTE	Applies from SW version: 1.1		
Meaning:	A tool is selected in the program with the T function. The setting in this machine data determines whether the new tool is loaded immediately on execution of the T function: MD = 0 The new tool is changed immediately with the T function. This setting is used mainly on turning machines with tool turrets. MD = 1 The new tool is prepared for changing with the T function. This setting is used mainly on milling machines with a tool magazine, in order to bring the new tool into the tool change position without interrupting the machining process. The M function entered in MD 22560 TOOL_CHANGE_M_CODE removes the old tool from the spindle and loads the new tool into the spindle. According to DIN 66025, this tool change must be programmed with the M function M06.		
Corresponding to...	MD 22560 TOOL_CHANGE_M_CODE		
Further references:	Description of Functions: Coordinate Systems (K2)		

22560 MD number	TOOL_CHANGE_M_CODE M function for tool change		
Default setting: 6	Minimum input limit: 0	Maximum input limit: 9999 9999	
Changes effective after POWER ON	Protection level: 2/4	Unit: –	
Data type: DWORD	Applies from SW version: 1.1		
Meaning:	This MD is only effective if MD 22550 TOOL_CHANGE_MODE = 1. If a new tools is only prepared for tool change with the T function (on milling machines with a tool magazine, this setting is mainly used to put the new tool into the tool change position concurrently with the main run), the tool change must be initiated with a further M function. The M function entered in the MD initiates the tool change (remove old tool from the spindle and load the new tool in the spindle). This tool change is required to be programmed with M function M06, in accordance with DIN66025.		
Corresponding to...	MD 22550 TOOL_CHANGE_MODE		
Further references:	Description of Functions: Tool Offset (W1)		

22562 MD number	**TOOL_CHANGE_ERROR_MODE** Error reaction with programmed tool change		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 3	
Changes effective after POWER ON	Protection level: 2/4	Unit: –	
Data type: DWORD	Applies from SW version: 5.1		
Meaning:	If MD 22550 is set to 0, the default setting of MD 22562 should not be altered. Bit 0=0: Default response: The program stops at the NC block in which the error occurred. Bit 0=1: If the error occurs in the block containing the tool change preparation command, the alarm activated by the preparation command (T) is ignored until the program run reaches the point at which the associated tool change command (M06) is interpreted. Only then is the alarm output that was triggered by the preparation command. It is therefore not possible for the user to make corrections until this block is reached. Bit 1=0: With active tool management only: In preparing tool changes, the NCK detects only tools with data assigned to a magazine. Bit 1 = 1: With active tool management only: The NCK also changes a tool whose data are known in the NCK but not assigned to a magazine. In this case, the NCK attempts to assign the tool data to the programmed spindle location automatically. If several tools can be used, an active tool is searched for again. If none is available, the tool with the lowest duplo number is selected. Bit 2 = 0 Active D no. > 0 and active T no. = 0 produces an offset of zero Active DL no. > 0 and active D no. = 0 produces a total offset of zero Bit 2 = 1 Active D no. > 0 and active T no. = 0 triggers an alarm message Active DL no. > 0 and active D no. = 0 triggers an alarm message Bit 3 and 4: Only significant if tool management is active. Response of init. block generation on program START if blocked tool is on the spindle and it is to be activated. See here in particular: $MC_START_MODE_MASK and $MC_RESET_MODE_MASK. At RESET in particular, the response 'leave disabled tool'active on the spindle is not affected. Bit 3 = 0 If the tool on the spindle is blocked: Generate tool change command that requests a replacement tool. If there is none an alarm is output. Bit 3 = 1 The blocked status of the spindle tool is ignored. The tool becomes active. The following part program should be formulated such that no parts are machined with the blocked tool. Bit 4 = 0 An attempt is made to activate the spindle tool and its replacement tool. Bit 4 = 1 If the tool on the spindle is blocked T0 is programmed in the start init. block.		
Corresponding to...	MD 22550 TOOL_CHANGE_MODE		
Further references:	Description of Functions: Tool Offset (W1)		

8.3.3 Creating and loading the configuration file

To start up the tool management function, you must create a configuration file and load it to the NC.

Create a new configuration file for tool management or adapt the examples given in the Toolbox.

Note

Make sure that you adapt the data in the configuration file with the machine data for tool management.

The configuration file must include the following settings:

- Define the type of search strategy
- Define the real magazine
- Define buffer magazine
- Define load magazine
- Define locations for the real magazine
- Define locations for the buffer magazine
- Define the spindle assignment
- Define the locations for the load magazine
- Define the distances for the real magazine

Load the configuration file to the NC.

Examples

The following examples can be found in the Toolbox under TOOLS\SD:

- TM_WO_GR.8X0 (configuration without dual gripper, e.g. for a disk-type magazine) containing the following:
  - 1 real magazine with 30 locations
  - 1 spindle
  - 2 load points
- TM_W_GR.8X0 (configuration with dual gripper, e.g. for a chain magazine) containing the following:
  - 1 real magazine with 30 locations
  - 1 spindle
  - 2 grippers
  - 2 load points

If necessary, adapt the configuration files in the lines typed in **bold** print.

Configuration file TM_W_GR.8X0

```
%_N_TO_TMA_INI
CHANDATA (1)
;--------------------
;Magazine configuration
;--------------------

;Delete old data
;----------------
$TC_MAP1 [0]=0
$TC_DP1 [0,0]=0

;Type of search strategy
;-----------------
$TC_MAMP2=257          ; search for active tools
                       ,1st location forward

;Magazine definition
;--------------

;Real magazine
$TC_MAP1 [1]=1         ; Magazine type (1: chain)
$TC_MAP3 [1]=17        ; magazine status (17: active
                       ; magazine enabled for loading)
$TC_MAP6 [1]=1         ; Number of magazine rows
$TC_MAP7 [1]=30        ; Number of locations

;Buffer magazine
$TC_MAP1 [9998]=7      ; Magazine type (7: buffer)
$TC_MAP3 [9998]=17
$TC_MAP6 [9998]=1
$TC_MAP7 [9998]=3      ; Number of buffer locations
                       ; (3: spindle with dual gripper)

;Loading magazine
$TC_MAP1 [9999]=9      ; Magazine type (9: loading magazine)
$TC_MAP3 [9999]=17
$TC_MAP6 [9999]=1
$TC_MAP7 [9999]=2      ; Number of loading points

;Locations in the real magazine
;------------------------------

;Location No 1
$TC_MPP1 [1,1]=1       ; Location type (1: Magazine
                       ; location)
$TC_MPP2 [1,1]=1       ; Location type
$TC_MPP3 [1,1]=1       ; Consider adjacent location (1: on)
$TC_MPP4 [1,1]=2       ; Location status (2: Location free)
$TC_MPP5 [1,1]=1       ; Location type index (1: location
                       ; no. 1)

;Location No 2
$TC_MPP1 [1.2]=1       ; Location type (1: Magazine
                       ; location)
$TC_MPP2 [1.2]=1       ; Location type
$TC_MPP3 [1.2]=1       ; Consider adjacent location (1: on)
$TC_MPP4 [1,2]=2       ; Location status (2: Location free)
$TC_MPP5 [1.2]=2       ; Location type index (2: location
                       ; no. 2)
```

```
;Location No 3
$TC_MPP1 [1.3]=1       ; Location type (1: Magaz. location)
$TC_MPP2 [1.3]=1       ; Location type
$TC_MPP3 [1.3]=1       ; Consider adjacent location (1: on)
$TC_MPP4 [1,3]=2       ; Location status (2: Location free)
$TC_MPP5 [1.3]=3       ; Location type index (3: loc. no. 3)
.
.
.

;Location No 29
$TC_MPP1 [1.29]=1      ; Location type (1: Magaz. location)
$TC_MPP2 [1.29]=1      ; Location type
$TC_MPP3 [1.29]=1      ; Consider adjacent location (1: on)
$TC_MPP4 [1,29]=2      ; Location status (2: Location free)
$TC_MPP5 [1.29]=29     ; Locat. type index (29: loc. no. 29)

;Location No 30
$TC_MPP1 [1.30]=1      ; Location type (1: Magaz. location)
$TC_MPP2 [1.30]=1      ; Location type
$TC_MPP3 [1.30]=1      ; Consider adjacent location (1: on)
$TC_MPP4 [1,30]=2      ; Location status (2: Location free)
$TC_MPP5 [1.30]=30     ; Locat. type index (30: loc. no. 30)

;Locations in the buffer magazine
;------------------------------

;Spindle
$TC_MPP1 [9998,1]=2    ; Location type (2: Spindle)
$TC_MPP2 [9998,1]=0    ; Location type
$TC_MPP3 [9998,1]=0    ; Consider adjacent location
$TC_MPP4 [9998,1]=2    ; Location status (2: Location free)
$TC_MPP5 [9998,1]=1    ; Location type index (1: loc. no. 1)

;Gripper 1
$TC_MPP1 [9998,2]=3    ; Location type (3: Gripper)
$TC_MPP2 [9998,2]=0    ; Location type
$TC_MPP3 [9998,2]=0    ; Consider adjacent location
$TC_MPP4 [9998,2]=2    ; Location status (2: Location free)
$TC_MPP5 [9998,2]=1    ; Location type index (1: loc. no. 1)

;Gripper 2
$TC_MPP1 [9998,3]=3    ; Location type (3: Gripper)
$TC_MPP2 [9998,3]=0    ; Location type
$TC_MPP3 [9998,3]=0    ; Consider adjacent location
$TC_MPP4 [9998,3]=2    ; Location status (2: Location free)
$TC_MPP5 [9998,3]=2    ; Location type index (2: loc. no. 2)

;Assignment of buffers to spindle
;-------------------------------------

$TC_MLSR [2,1]=0       ; 1st gripper
$TC_MLSR [3,1]=0       ; 2nd gripper

;Locations in the loading magazine
;------------------------------

;1st loading station
$TC_MPP1 [9999,1]=7    ; Location type (7: Loading point)
$TC_MPP2 [9999.1]=0    ; Location type
$TC_MPP3 [9999.1]=0    ; Consider adjacent location
$TC_MPP4 [9999.1]=2    ; Location status (2: Location free)
$TC_MPP5 [9999.1]=1    ; Location type index (1: loc. no. 1)
```

```
;2nd loading station
$TC_MPP1 [9999.2]=7    ; Location type (7: Loading point)
$TC_MPP2 [9999.2]=0    ; Location type
$TC_MPP3 [9999.2]=0    ; Consider adjacent location
$TC_MPP4 [9999.2]=2    ; Location status (2: Location free)
$TC_MPP5 [9999.2]=2    ; Location type index (2: location
                       ; no. 2)

;Distances between load points/buffers and real magazine
;------------------------------------------------------

$TC_MDP2 [1,1]=0       ; Spindle
$TC_MDP2 [1,2]=0       ; Gripper 1
$TC_MDP2 [1,3]=0       ; Gripper 2
$TC_MDP1 [1,1]=0       ; 1st loading point
$TC_MDP1 [1,2]=0       ; 2nd loading point

M17
```

Variable description

The main variables for the configuration file are described here. For a detailed description of the system variables, please refer to:

References: /FBW/, Description of Tool Management Functions

Magazine data $TC_MAP1

$TC_MAP1[MagazineNo]= Magazine type

- 1: Chain
- 3: Turret
- 5: Flat magazine
- 7: Internal magazine tool buffer
- 9: Internal magazine loading station

Magazine data $TC_MAP3

$TC_MAP3[MagazineNo]= Magazine status

Bit mask (specification applies for bit=1):

- Bit 0: Active magazine
- Bit 1: Blocked
- Bit 2: Magazine is at load position
- Bit 3: Tool motion is active
- Bit 4: Enabled for loading

Default = 17 means: Active magazine, enabled for loading

Magazine data $TC_MAP6

Number of magazines (in this case: 1)

Magazine data $TC_MAP7

Number of locations,
e.g. number of buffer locations: 3 = 1 spindle and 2 grippers

Search strategy $TC_MAMP2

$TC_MAMP2= Type of search strategy

This mask is divided into a right and left byte,

- the right byte describes the tool search (bits 0 and 1)
- and the left byte describes the empty location search for the spindle tool.

A value must be specified for both strategies.

Bit mask (specification applies for bit=1):

- Bit 0: Search for active tool with designation (1)
- Bit 1: Search for next tool with designation (2)
- Bit 8: Search from 1st location onwards (256)
- Bit 9: Search from current location onwards (512)
- Bit 10: Search from last location backwards (1024)
- Bit 11: Search from current location backwards (2048)
- Bit 12: Search from current location symmetrically (4096)

Example: $TC_MAMP2=4097 (bit 12 and bit 0=1)

Bit 12: Search for empty location: search from current location symmetrically,
Bit 0: Tool search: Search for active tool

Location type $TC_MPP1

$TC_MPP1[MagazineNo, LocNo]= Type of location:

- 1 = Magazine location
- 2 = Spindle
- 3 = Gripper
- 4 = Loader
- 5 = Transfer location
- 6 = Loading station
- 7 = Load point

Default: value of corresponding location type

Location type $TC_MPP2

$TC_MPP2[MagazineNo, LocNo]= Type of location:

Any values can be entered here. The values must match the tools to be loaded into the location.
Buffers and loading points have value 0!

Consider adjacent location $TC_MPP3

$TC_MPP3[MagazineNo, LocNo]= Consider adjacent location ON = 1

- Value = 1: An adjacent location is considered for the location
- Value = 0: No adjacent location is considered for the location
- Value = 0: Must be entered for buffer and load locations!

Location status $TC_MPP4

$TC_MPP4[MagazineNo, LocNo]= Location status (bit mask)

- Bit 0: Blocked
- Bit 1: Free/allocated

Default: 2 = Location free

Location type index $TC_MPP5

$TC_MPP5[MagazineNo, LocNo]= Location type index

For $TC_MPP1[Magazine No., Location No.]=1 (location type is the magazine location), the location number is entered here. For other location types, the type index is incremented:

Example with 2 grippers with location type 3

- the first gripper has location index 1
- the second gripper has location index 2

Distances to magazine

Distances to magazine

$TC_MDP2[MagazineNo, BufferNo.]= Distances between buffer and magazine

A value must be entered for each buffer, at least a zero. The value is not interpreted here but is used only for assignment.

$TC_MDP1[MagazineNo, BufferNo.]= Distances between load points and magazine

One value must be entered for each load location here. It is interpreted when calculating the location before the load point. Only for “Load point for spindle” (location 1) is the value not interpreted but used “only” for magazine assignment.

Spindle assignment

$TC_MLSR[LocationNo of BUFF, LocationNo of spindle]= Assignment between buffer and spindle.
This enables determination of which buffer, e.g. gripper, may carry out tool change to the spindle.

In ShopMill the tool change is initiated by a tool-changing cycle. This cycle is called from the ShopMill cycles where a tool can be programmed.

8.4 Start-up in the PLC

Requirements

- PCU start-up is performed and the connection to the NC established.
- NC start-up with the NC machine data for tool management is complete.
- The basic PLC program is loaded.

General

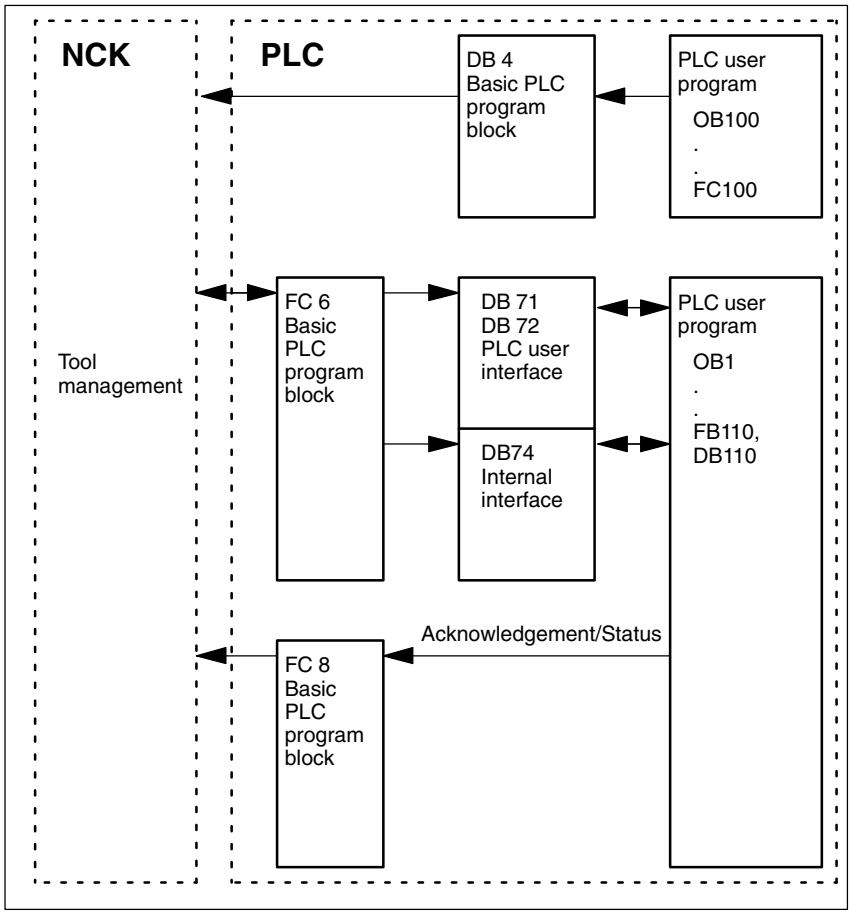


Fig. 8-1 Overview of tool management

FC 6 supplies data blocks DB71/72 with the information for the new and old tools. Block FC 6 is called by the basic PLC program and must not be called again in the PLC user program.

So that the tool management always knows where the current tool is located, each location change must be notified to the tool management via FC8 (transfer block). The FC 8 (transfer block) is called by the user program.
FB110 is provided as an example.

The data blocks DB71/72 and 74 are set up automatically. The lengths of the data blocks are determined by the parameters for the tool management in DB4.
DB4 is written to by the PLC user program.
FC100 is provided as an example.

Execution

Implement call FC 8 and create PLC data (DB4).
Either adapt the examples for blocks FC 8 and DB4 from the ShopMill library or use your own blocks.

8.4.1 Example for FC 100 and FB 110

The ShopMill library contains two sources as examples of tool management.

Procedure

- Adapt one of the following source files and compile it:
  - TM_WO_GR.AWL (data transfer without dual gripper, e.g. for a disk-type magazine)
  - TM_W_GR.AWL (data transfer with dual gripper, e.g. for a chain magazine)

  Source files TM_WO_GR.AWL and TM_W_GR.AWL contain the following blocks
  - FC 100 (block for the PLC data of tool management)
  - FB 110, DB 110 (blocks for data transfer in tool management)

  The blocks for transferring tool management data (FB110, DB110) must be adapted to suit the individual machine.
- Load the generated blocks to the PLC
- Call the blocks in OB 1 and OB 100:
  - Call FC 100 in OB 100 (before FB 1)
  - Call FB 110 in OB 1 (after FC 30)

  The specified call sequence for these blocks is mandatory.

FC 100

Block FC 100 transfers the tool management PLC data to DB4.

The PLC data is set up for 2 loading points (DB71), one toolholder (DB72) and the tool turret (DB73).
The signals for DB71, DB72 and DB73 are found in Subsection 8.4.2 “Signal Description”.

The “Real MagLoc” parameter of FC 100 (number of locations of the real magazine) must be assigned values when FC 100 is called.

FB 110

Block FB 110 controls the data transfer for tool management.

The block includes the following functions:

- Acknowledge load/unload/relocate for 1st load point
- Acknowledge load/unload for 2nd load point
- Acknowledge prepare/change for 1st spindle
- Abort, i.e. negative acknowledgment for the above-mentioned functions

The acknowledgment for these functions can be enabled by the PLC via the input parameter of FB 110, e.g. confirm load/unload via user key.
The default settings for the input parameters are for automatic acknowledgement meaning that block FB 110 can be used on test stations that do not have a link to the machine (see Table 8-1 or 8-2). Automatic acknowledgment is implemented by means of interface signals of the tool management data blocks which you can skip individually.

Data transfer without dual gripper

FB110 from the AWL source TM_WO_GR.AWL may be used for data transfer without dual gripper.

Tool change from the magazine to the spindle is carried out in one step here. The tool magazine is changed directly into the spindle.

Table 8-1 Input parameters of FB110 from TM_WO_GR.AWL

Signal	Type	Default	Remarks
Prepare_IF1	BOOL	TRUE	Acknowledge preparation for spindle 1
Change_IF1	BOOL	TRUE	Acknowledge change for spindle 1
Load_IF1	BOOL	TRUE	Acknowledge loading for load point 1
Unload_IF1	BOOL	TRUE	Acknowledge unloading for load point 1
Relocate_IF1	BOOL	TRUE	Acknowledge relocation for load point 1
Load_IF2	BOOL	TRUE	Acknowledge loading for load point 2
Unload_IF2	BOOL	TRUE	Acknowledge unloading for load point 2
Reset_IF	BOOL	FALSE	Abort for one of the above-mentioned functions

Note

MD 9673 CMM_TOOL_LOAD_STATION defines the interface via which the magazine will be loaded or unloaded.

Data transfer with dual gripper

FB 110 from the AWL source TM_W_GR.AWL may be used for data transfer with dual gripper.

The tool change is carried out in two steps by the magazine in the spindle. The tool is first moved from the magazine to the gripper and then onto the spindle.

Table 8-2 Input parameters of FB 110 from TM_W_GR.AWL

Signal	Type	Default	Remarks
Prepare_IF1	BOOL	TRUE	Enable preparation for spindle 1
Change1_IF1	BOOL	TRUE	Enable change step 1 (via gripper 1/2) for spindle 1
Change2_IF1	BOOL	TRUE	Enable change step 2 (via gripper 1/2) for spindle 1
Load_IF1	BOOL	TRUE	Enable loading for load point 1
Unload_IF1	BOOL	TRUE	Enable unloading for load point 1
Relocate_IF1	BOOL	TRUE	Enable relocation for load point 1
Load_IF2	BOOL	TRUE	Enable loading for load point 2
Unload_IF2	BOOL	TRUE	Enable unloading for load point 2
Reset_IF	BOOL	FALSE	Abort for one of the above-mentioned functions

Note

MD 9673 CMM_TOOL_LOAD_STATION defines which interface will be loaded/unloaded.

8.4.2 Signal description

Overview of data blocks

The following data blocks are used by the tool management, i.e. they must not be assigned by the PLC user program:

DB 71 for loading/unloading stations
DB 72 for spindle as change point
DB 74 internal data block for tool management

If you need to change the data of magazines, buffers or loading positions, delete data blocks DB 71 to DB 74 and restart the PLC.

Description of DB71

DB71 Data Block	**Signals of load/unload points** NCK –>PLC interface							
Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	Interfaces							
DBB 0	INT 8	INT 7	INT 6	INT 5	INT 4	INT 3	INT 2	INT 1
DBB 1	INT 16	INT 15	INT 14	INT 13	INT 12	INT 11	INT 10	INT 9
DBB 2, 3								
DBB n + 0				NC program positions magazine	Position at load point	Relocate	Unload	Load
DBB n + 1	Unassigned							
DBB n + 2	Assigned channel (8bit-Int)							
DBB n +3	Tool management number (8bit-Int)							
DBD n + 4	$P_VDITCP[0] User parameter 0 (DWord)							
DBD n + 8	$P_VDITCP[1] User parameter 1 (DWord)							
DBD n + 12	$P_VDITCP[2] User parameter 2 (DWord)							
DBW n + 16	Identifier for load/unload point (Int), (fixed value 9999)							
DBW n + 18	Location no. of load/unload point (Int)							
DBW n + 20	Magazine no. (source) for loading/relocation/positioning (Int)							
DBW n + 22	Location no. (source) for loading/relocation/positioning (Int)							
DBW n + 24	Magazine no. (target) for loading/relocation/positioning (Int)							
DBW n + 26	Location no. (target) for loading/relocation/positioning (Int)							
DBW n + 28 HMI to PLC								Load/ unload without moving magazine

Initial addresses of load/unload locations:

Load/unload location 1: n = 4
2: n = 34
3: n = 64
4: n = 94

Example calculation of address DBW n+24 (magazine no. target)

n = (m–1) * len + 4 m = location no. of load station/point
len = 30 (length of one load point)

m =2 ; len = 30 n = (2–1) * 30 + 4 ==> n = 34
DBW (34 + 24) = DBW 58

Address for magazine no. target of 2nd load point is DBW 58.

Load point 1 is intended for loading/unloading in all spindles. This must be taken into account in the load interface assignment (applies to PCU 20; automatically taken into account in PCU 50). Load point 1 is also used to relocate/position tools in any location (e.g. buffer location).

Description of DB72

DB72 Data block	**Spindle as change position** Interface NCK–>PLC							
Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DBB 0	INT 8	INT 7	INT 6	INT 5	INT 4	INT 3	INT 2	INT 1
DBB 1	INT 16	INT 15	INT 14	INT 13	INT 12	INT 11	INT 10	INT 9
DBB 2, 3								
DBB n + 0	Reserved	Detach manual tool	Attach manual tool	OldTool in BL No. (n+42)	TO	Prepare change	Change tool (initiated by: M06)	Obligatory change
DBB n + 1	Unassigned							
DBB n + 2	Assigned channel (8-bit Int)							
DBB n + 3	Tool management number (8bit-Int)							
DBD n + 4	$P_VDITCP[0] User parameter 0 (DWord)							
DBD n + 8	$P_VDITCP[1] User parameter 1 (DWord)							
DBD n + 12	$P_VDITCP[2] User parameter 2 (DWord)							
DBW n + 16	Buffer identifier (Int), fixed value 9998) equals “Target position for new tool”							
DBW n + 18	Relative location (target) in buffer magazine (Int)							
DBW n + 20	Magazine no. (source) for new tool (Int)							
DBW n + 22	Location no. (source) for new tool (Int)							
DBW n + 24	Magazine no. (target) for old tool (Int)							
DBW n + 26	Location no. (target) for old tool (Int)							
DBW n + 28	New tool: Location type (Int)							
DBW n + 30	New tool: Size left (Int)							
DBW n + 32	New tool: Size right (Int)							
DBW n + 34	New tool: Size top (Int)							
DBW n + 36	New tool: Size bottom (Int)							
DBW n + 38	Tool status for new tool							
	Tool has been used	Tool with fixed loc. code		Prewarn lim. reached	Measure tool		Enable tool	Active tool
DBW n + 40	New tool: Internal T no. of NCK (Int)							
DBW n + 42	If DBX (n+0.4) = 1, then the buffer location of the old tool must be entered here							
DBW n + 44	Reserve							
DBW n + 46	Reserve							

Initial addresses of spindles:	Spindle 1: n = 4 Spindle 2: n = 52 Spindle 3: n = 100
n = (m–1)* len + 4	m = Location no. of change position len= 48

Note

DBB (n+1) to DBW (n+46) are updated **only** by a T selection.

For a description of data blocks DB71 and DB74, please see
References: /FBW/, Description of Functions Tool Management

DB 72 **DBX 0.0 – 0.15** Data block	**Active status of interface 1–16** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Signal state 1	Associated interface has a valid block, a tool change request has been initiated.		
Signal state 0	Operation for this interface has ended.		

DB 72 **DBB(n+0)** Data block	**Tool change information** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 5
Meaning	Bit 0: Obligatory change Bit 1: Change tool (initiated by M06) Bit 2: Prepare change Bit 3: “T 0” is programmed Bit 4: Old tool in buffer number (n+42) Bit 5: Attach manual tool Bit 6: Detach manual tool Bit 7: Reserved		

Note

The bits in DBB (n+0) (prepare change, change tool,...) are **not** reset by the system. They are up-to-date only if the appropriate interface bit in DBB0 is set to ‘’1”. However, the bits can be reset by the user if necessary.

DB 72 **DBB(n+2)** Data block	**Assigned channel** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid as of SW: 2
Meaning	Channel no. to which active interface applies		

DB 72 **DBB(n+3)** Data block	**Tool management no.** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Associated tool management number		

DB 72 **DBD(n+4)** Data block	**User parameter 0 (DInt)** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Programming of $P_VDITCP[0]=(value) can be used to transfer a value to the PLC via the parts program.		

DB 72 **DBD(n+8)** Data block	**User parameter 1 (DInt)** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Programming of $P_VDITCP[1]=(value) can be used to transfer a value to the PLC via the parts program.		

DB 72 **DBD(n+12)** Data block	**User parameter 2 (DInt)** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Programming of $P_VDITCP[2]=(value) can be used to transfer a value to the PLC via the parts program.		

DB 72 **DBW(n+16)** Data block	**Buffer magazine no. (fixed value 9998) target position for new tool** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Magazine no. 9998 for all buffer magazines, target magazine for new tool		

DB 72 **DBW(n+18)** Data block	**Location in buffer magazine (spindle)** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Location of buffer magazine to which the new tool must be loaded. This is normally the spindle. The location number defined for this particular buffer during start-up is output.		

DB 72 **DBW(n+20)** Data block	**Magazine no. (source) for new tool** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Source magazine no. of new tool		
Corresponding to...	DBW(n+22)		

DB 72 **DBW(n+22)** Data block	**Location no. (source) for new tool** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid as of SW:: 2
Meaning	Source location no. of new tool		
Corresponding to...	DBW(n+20)		

DB 72 **DBW(n+24)** Data block	**Magazine no. (target) for old tool** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Number of magazine to which old tool must be loaded.		
Corresponding to...	DBW(n+26)		

DB 72 **DBW(n+26)** Data block	**Location no. (target) for old tool** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Number of location to which old tool must be loaded.		
Corresponding to...	DBW(n+26)		

DB 72 **DBW(n+28)** Data block	**Tool new: Location type** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	The location type of the new tool is entered here.		
Corresponding to...	Tool size: Left, right, top, bottom		

DB 72 **DBW(n+30)** Data block	**Tool new: Size left (Int)** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Specification of new tool size **on left** in half locations.		

DB 72 **DBW(n+32)** Data block	**Tool new: Size right (Int)** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Specification of new tool size **on right** in half locations.		

DB 72 **DBW(n+34)** Data block	**Tool new: Size top** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Specification of new tool size **at top** in half locations.		

DB 72 **DBW(n+36)** Data block	**Tool new: Size bottom** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Specification of new tool size **at bottom** in half locations.		

DB 72 **DBW(n+38)** Data block	**Tool status for new tool** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Bit 0: Active tool Bit 1: Tool enabled Bit 2: Tool disabled Bit 3: Tool measured Bit 4: Prewarning limit reached Bit 5: Tool being changed Bit 6: Tool is fixed-location coded Bit 7: Tool was in use		

DB 72 **DBW(n+40)** Data block	**Tool new: Internal T no. of NCK** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Meaning	Display of internal T no. of NCK for the new tool.		

DB 72 **DBW(n+42)** Data block	**Reserved** Signal(s)		
Edge evaluation:		Signal(s) updated:	Signal(s) valid from SW:
Meaning			

DB 72 **DBW(n+44)** Data block	**Reserved** Signal(s)		
Edge evaluation:		Signal(s) updated:	Signal(s) valid from SW:
Meaning			

DB 72 **DBW(n+46)** Data block	**Reserved** Signal(s)		
Edge evaluation:		Signal(s) updated:	Signal(s) valid from SW:
Meaning			

8.5 Display machine data

Via Display machine data you can activate certain functions and settings at the operator interface.

MD 9450 $MM_WRITE_TOA_FINE_LIMIT
Limit value for wear fine

MD 9478 $MM_TO_OPTION_MASK
Settings for ShopMill

MD 9639 $MM_CTM_MAX_TOOL_WEAR
Upper input limit for tool wear

MD 9651 $MM_CMM_TOOL_MANAGEMENT
Tool management variant

MD 9652 $MM_CMM_TOOL_LIFE_CONTROL
Tool monitoring

MD 9661 $MM_CMM_ENABLE_CUSTOMER_M_CODES
Number of input fields for tool-specific functions

MD 9663 $MM_CMM_TOOL_DISPLAY_IN_DIAM
Radius/diameter display for tool

MD 9667 $MM_CMM_FOLLOW_ON_TOOL_ACTIVE
Tool preselection active

MD 9671 $MM_CMM_TOOL_LOAD_DEFAULT_MAG
Load tool in default magazine

MD 9672 $MM_CMM_FIXED_TOOL_PLACE
Fixed location coding

MD 9673 $MM_CMM_TOOL_LOAD_STATION
Number of loading station

MD 9674 $MM_CMM_ENABLE_TOOL_MAGAZINE
Display of magazine list

MD 9687 $MM_CMM_TOOL_MOVE_DEFAULT_MAG
Move tool to default magazine

The default setting and machine data description can be found in Section 7.2 “Display Machine Data for ShopMill”.

8.6 Tool change cycle

Sequence

The ShopMill tool change cycle performs the following tasks:

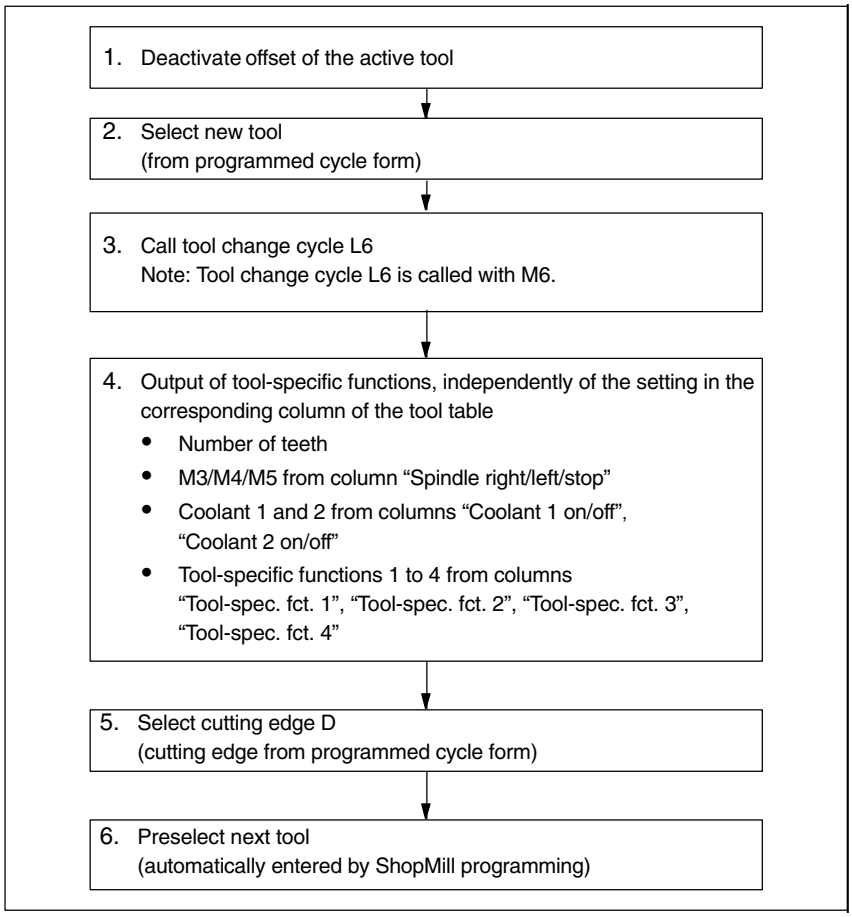


Fig. 8-2 ShopMill tool change cycle

Note

The number of teeth is stored in tool edge parameter 24 ($TC_DP24), the spindle direction of rotation, the coolant, and the tool-specific functions in tool edge parameter 25 ($TC_DP25).

You need to create a tool change cycle, e.g. L6, for the machine-specific parts of the tool change.

Example

Example L6.SPF in the Toolbox shows how to do this. This example requires:

- MD 22550 $MC_TOOL_CHANGE_MODE=1
  Tool change via M function.
- MD 10715 $MN_M_NO_FCT_CYCLE[0]=6
  M function (M6) used to call the tool change, i.e. the subroutine assigned via MD 10716 $MN_M_NO_FCT_CYCLE_NAME[0].
- MD 10716 $MN_M_NO_FCT_CYCLE_NAME[0]="L6"
  Name of the subroutine (L6) to be executed after the M function defined in MD 10715.
  If the subroutine name is to be entered via program or MDA, the name must be placed between quotation marks. This does not apply to manual inputs.
- MD 22560 $MC_TOOL_CHANGE_M_CODE=206
  M function (M206) with which the tool change is defined for the tool management.

The machine data specified above can be found in the tool box in machine data set CMM.8X0.

```
PROC L6 SAVE
;_____________________________________________________________
;Example of tool change cycle for machine manufacturer
;_____________________________________________________________
DEF INT _WZ_IN_SP,_WZ_VOR
DEF REAL _WWP=...                ; Tool change position
                                 ; MKS
DEF REAL _SPP=...                ; Spindle position
;
IF (NOT $P_SEARCH)               ; If no block search
  _WZ_IN_SP=$TC_MPP6[9998,1]     ; Tool on spindle
  GETSELT(_WZ_VOR)               ; Preselected tool
  ;
  IF (_WZ_IN_SP<>_WZ_VOR)        ; If other tool
    ; Position spindle:
    SPOS=_SPP
    ; Approach tool change position:
    SUPA D0 G0 G90 G40 G60 Z=_WWP
  ENDIF
ELSE
  IF (E_SIM_ACTIVE)              ; If simulation active
    ; Approach tool change position:
    SUPA D0 G0 G90 G40 G60 Z=_WWP
  ENDIF
ENDIF
;
;Load tool: Tool management and PLC
M206
M17
```

Note

In the example of tool change cycle L6 you must replace "..." with values in lines "DEF REAL _WWP=..." and "DEF REAL _SPP=...".

Tool change cycle L6 contains the following steps:

1. Position spindle (not when simulation is active)
2. Approach tool change positions in the machine coordinate system
3. Execute tool change (M206)

The tool must be at a safe height after tool change so that all motions in the plane are permissible.

8.7 Manual tools

Manual tools are tools which are required during machining, but are only available in the tool list but not in the tool-holding magazine. These tools must be attached/detached manually to/from the spindle.

Via MD 22562 $MC_TOOL_CHANGE_ERROR_MODE,
Bit 1=1, tools without magazine location assignment can additionally be selected on a tool change.

An alarm is output every time the manual tool is loaded, unloaded or replaced. (e.g.: “Channel 1, manual tool cutter20, duplo no. 1 load to toolholder 1.” I.e. that manual tool cutter20 should be loaded into the spindle.)

Manual tools are identified by magazine location 1 in magazine 9999 in the interface to the PLC. Bit 5 in DB72 DBB (n+0) is set to load the tool and bit 6 to unload it.

8.8 Activating the spindle, coolant, and tool-specific functions

Spindle, coolant

Here you can assign direction of rotation (CW/CCW/off) and coolant to a tool.

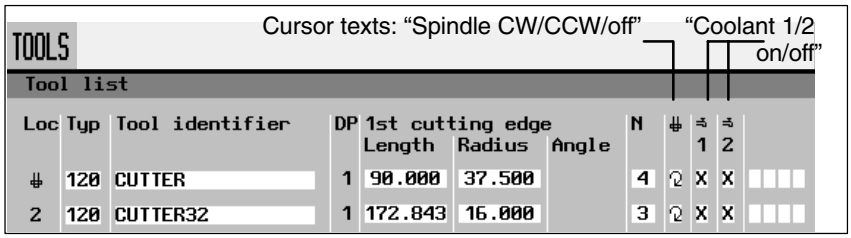


Fig. 8-3 Tool list: Coolant and spindle direction of rotation

You assign the coolants to the appropriate M functions via the following machine data:
MD 9680 $MM_CMM_M_CODE_COOLANT_I
MD 9681 $MM_CMM_M_CODE_COOLANT_II
MD 9668 $MM_CMM_M_CODE_COOLANT_I_AND_II
MD 9686 $MM_CMM_M_CODE_COOLANT_OFF

Tool-specific functions

Tool-specific functions 1...4 are intended for other machine functions that can be activated for a tool, for example, third coolant, speed monitoring, tool breakage etc.

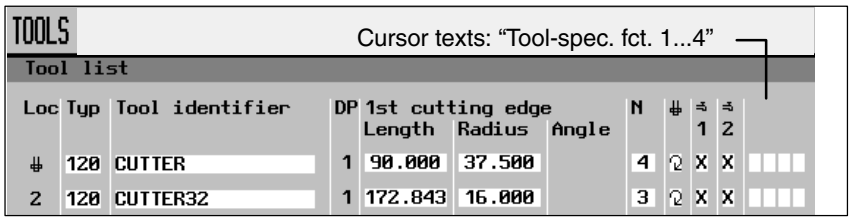


Fig. 8-4 Tool list: Tool-specific functions 1...4

The fields in the tool list can be hidden with display MD 9661 CMM_ENABLE_CUSTOMER_M_CODES = 0.
The tool-specific functions 1 to 4 are output by the ShopMill tool change cycle after the M6 for a PLC cycle in DB82.

Tool-specific functions 1..4 in DB82:

DB82 DBX42.0 CMM_OUT.tool_m_function.funtion_1_on
DB82 DBX42.1 CMM_OUT.tool_m_function.funtion_2_on
DB82 DBX42.2 CMM_OUT.tool_m_function.funtion_3_on
DB82 DBX42.3 CMM_OUT.tool_m_function.funtion_4_on

DB82 DBX42.4 CMM_OUT.tool_m_function.funtion_1_activ
DB82 DBX42.5 CMM_OUT.tool_m_function.funtion_2_activ
DB82 DBX42.6 CMM_OUT.tool_m_function.funtion_3_activ
DB82 DBX42.7 CMM_OUT.tool_m_function.funtion_4_activ

Bits DB82.DBX42.4...7 indicate whether the function displayed in bits DB82.DBX42.0...3 is valid. The signal is low active.

Example

The following functions are programmed in screen form “Machine functions” under menu “Program” → “Straight-line-circle”:
Tool-specific function 1: on
Tool-specific function 2: no change
Tool-specific function 3: off
Tool-specific function 4: no change

M functions M1=100 and M10=101 are generated. The following bits are set in DB82.DBB42:

Table 8-3 DB82.DBB42

Bit	Status	Function
0	1	Switch on tool-spec. function 1
1	0	Tool spec. function 2 no change
2	0	Switch off tool-spec. function 3
3	0	Tool spec. function 4 no change
4	0	Accept function from bit 0
5	1	Do not accept function from bit 1
6	0	Accept function from bit 2
7	1	Do not accept function from bit 3

Note

Tool-specific functions are output from the HMI to the ShopMill interface using M functions with extended address (see Chapter 3 “Reserved Functions”).

Special features of “MANUAL” mode

In “MANUAL” mode, no spindle direction of rotation, coolant and tool-specific M functions are output to the PLC. On tool change in the “MANUAL” mode, these functions can be initiated by the operator using the keys on the machine control panel (implementation via PLC user program).

Change cursor texts

You can change the cursor texts for “Coolant 1/2 on/off” and “Tool-spec. fct. 1, ...” (see Section 8.9 “Modifying Texts for Tool-specific Functions”).

8.9 Modifying texts for tool-specific functions

8.9.1 PCU 20

For tool-specific functions, you can modify the parameter texts in the “Prog. edit” → “Linear Circular” → “Machine Function” menu and the cursor texts in the tool list. Cursor texts are texts, shown in the message line when the cursor is positioned on the relevant input field.

You can use the ALUC.TXT text file on the application diskette to modify the texts of the tool-specific functions.

Text numbers

The texts are assigned to the following text numbers in the file ALUC.TXT:

Table 8-4 Text assignment

Cursor texts in the “Tool list” menu	**Text number**
Tool-specific function 1 (tool-spec. fct. 1)	89911
Tool-specific function 2 (tool-spec. fct. 2)	89912
Tool-specific function 3 (tool-spec. fct. 3)	89913
Tool-specific function 4 (tool-spec. fct. 4)	89914
Coolant 1	89921
Coolant 2	89922
Parameter texts in the menu “Program linear/circular machine functions”	
Tool-specific function 1 (tool-spec. fct. 1)	89915
Tool-specific function 2 (tool-spec. fct. 2)	89916
Tool-specific function 3 (tool-spec. fct. 3)	89917
Tool-specific function 4 (tool-spec. fct. 4)	89918
Coolant 1	89919
Coolant 2	89920

This means that text numbers 89911 and 89915 etc. refer to the same functions.

Note

The maximum number of character is 23 for the cursor texts and 14 for the parameter texts.

Language assignment

Each language directory contains a file named ALUC.TXT.

Procedure

To select ALUC.TXT file, proceed as follows:

- Switch to the subdirectory ...\INSTUTIL in the application environment.
- Call the APP_INST program.
- Select <2> “Modify configuration”.
- Specify whether the texts for the 1st or 2nd language are to be edited:

  <4> “Edit text files for first language” or

  <5> “Edit text files for second language”
- Scroll through the menu until the option “Alarm texts for user cycles”

  appears and then enter the corresponding number.

  This opens the ALUC.TXT text file with the DOS editor “edit”.
- Enter the texts of your choice.
- Save the file and close the editor.
- Press the “ESC” key twice.

The text modifications become operative when you take the following steps:

- Select <1> “Install all modules on hardware”.
- Confirm your language selection with “F4 Accept”.
- Select <2> “Create Flash Memory Card image”.
- Specify the source drive for the system diskettes.
- Specify the target path for the system diskettes.
- Enter the target drive to which the file must be saved.
- Specify the target path for the file.
- Use SINUCOPY to create a PC card (see Subsection 4.2.2 “Start-up on a PCU 20”).
- Load the PC card contents to the control (see Subsection 4.2.2 “Start-up on a PCU 20”).

Example

The cursor text “Tool-spec. function 1” in the tool list should be changed to “Air cooling”.

You must make the following entry in text file ALUC.TXT:

```
89911 0 0 ”Air cooling”
```

The two parameters 2 and 3 separated by blanks are control characters for text output and must always be set to 0.

8.9.2 PCU 50

For tool-specific functions, you can modify the parameter texts in the “Prog. edit” → “Linear Circular” → “Machine Function” menu and the cursor texts in the tool list. Cursor texts are texts, shown in the message line when the cursor is positioned on the relevant input field.

The desired texts must be entered in the text file F:\DH\CUS.DIR\ALUC_xx.COM. You may need to create the ALUC_xx.COM file in the CUS.DIR directory.
You must add the following line to the F:\USER\MBDDE.INI file in section [Text-Files]:

```
UserZYK=F:\dh\cus.dir\aluc_
```

Text numbers

The texts are assigned to the following text numbers in the file ALUC_xx.COM:

Table 8-5 Text assignment

Cursor texts in the “Tool list” menu	**Text number**
Tool-specific function 1 (tool-spec. fct. 1)	89911
Tool-specific function 2 (tool-spec. fct. 2)	89912
Tool-specific function 3 (tool-spec. fct. 3)	89913
Tool-specific function 4 (tool-spec. fct. 4)	89914
Coolant 1	89921
Coolant 2	89922
Parameter texts in the menu “Program linear/circular machine functions”	
Tool-specific function 1 (tool-spec. fct. 1)	89915
Tool-specific function 2 (tool-spec. fct. 2)	89916
Tool-specific function 3 (tool-spec. fct. 3)	89917
Tool-specific function 4 (tool-spec. fct. 4)	89918
Coolant 1	89919
Coolant 2	89920

This means that text numbers 89911 and 89915 etc. refer to the same functions.

Note

The maximum number of character is 23 for the cursor texts and 14 for the parameter texts.

Language assignment

The text language is assigned via the name of the text file. “xx” is replaced by one of the following codes in the text file name:

Table 8-6 Language assignment

Abbreviation xx	Language
gr	German
uk	English
fr	French
it	Italian
sp	Spanish
nl	Dutch
dk	Danish
fi	Finnish
bk	Swedish
pl	Polish
tr	Turkish
ch	Simplified Chinese
tw	Chinese (Traditional)
ko	Korean
hu	Hungarian
po	Brazilian Portuguese
ru	Russian
cz	Czech
yes	Japanese

Example

The cursor text “Tool-spec. function 1” in the tool list should be changed to “Air cooling”.

You must make the following entry in text file ALUC_GR.COM:

```
89911 0 0 ”Air cooling”
```

The two parameters 2 and 3 separated by blanks are control characters for text output and must always be set to 0.

You must add the following line to the F:\USER\MBDDE.INI file in section [Text-Files]:

```
UserZYK=F:\dh\cus.dir\aluc_
```

8.10 Configuring the operator interface

There are two ways you can modify the existing operator interface for the tool management system:

- In addition to the existing lists, you can activate a custom list on the 3rd horizontal softkey in the tool management.
- You can configure existing parameters as well as user-defined parameters in the existing lists (including the custom list). The options available may vary according to the tool.

8.10.1 Procedure

Proceed as outlined below to activate a custom list or modify the existing lists. For more detailed information on the configuration file and for creating the texts please refer to the following sections.

Activate custom list

- Define texts for the custom list (optional)
  You need to define new texts if you want to modify the default texts for the softkey labeling and the list header for your the custom list.
- Set machine data
  9478 $MM_TO_OPTION_MASK, Bit 2
  Activate custom list

Press the 3rd horizontal softkey in the tool management to display a list template with parameters “LROU” and “Location Type”.

Modifying lists

- Create configuration file
  You must store all the changes you have made to the lists from the default setting in the configuration file TO_MILL.INI.
- Define texts for customized parameters (optional)
  If you are using customized parameters, you need to define column headers and cursor texts for these parameters.
- Set machine data
  MD 9478 $MM_TO_OPTION_MASK, Bit 8
  Evaluate TO_MILL.INI file
- Set machine data for customized parameters (optional)
  If you are using customized parameters, you need the set the following machine data:
  MD 18080 $MN_MM_TOOL_MANAGEMENT_MASK, Bit 2
  Provide memory for user data
  MD 18094 $MN_MM_NUM_CC_TDA_PARAM
  Number of customized parameters
  MD 18095 $MN_MM_TYPE_CC_TDA_PARAM[n]=4
  Data type (DOUBLE) of the customized parameters
  MD 20310 $MC_TOOL_MANAGEMENT_MASK, Bit 2
  Activate user functions

8.10.2 Creating configuration file

You must store all the changes you have made to the lists from the default setting in the TO_MILL.INI configuration file.

Please note the following:

- You can define up to 13 columns after the “DP number” column.
- Define the tool edge parameters in consecutive columns.
- Define either edge parameters or tool parameters, but not both, in one column.

A sample configuration file is located in the TOOLS\SD directory. You can adapt this file if required.
With the PCU 20 you must put this configuration file on the application diskette and then install it together with the ShopMill software. With the PCU 50, copy the file to the OEM directory.

Syntax

The following syntax rules apply to entries in the configuration file (see also example at end of this chapter):

First specify in which tool management list you would like to make changes.

```
[DISPLAY_IDENTIFIER]
```

DISPLAY_IDENTIFIER: Tool management list

Next, define the changes themselves:

- Modify a specific column for all tools:

  ```
  COLUMNx=CONTENTS_IDENTIFIER
  ```

  COLUMN: Column command
  x: Column number, max. 13
  CONTENTS_IDENTIFIER: Parameter or property of tool

- Modify a specific column for a specific tool:

  ```
  TOOL_IDENTIFIER = x=CONTENTS_IDENTIFIER
  ```

  TOOL_IDENTIFIER: Tool type

- Define different columns for each tool:

  ```
  TOOL_IDENTIFIER = CONTENTS_IDENTIFIER / CONTENTS_
  IDENTIFIER / ...
  TOOL_IDENTIFIER = CONTENTS_IDENTIFIER / CONTENTS_
  IDENTIFIER / ...
  ...
  ```

  The parameters or properties of a tool are listed one after the other by means of a CONTENTS_IDENTIFIER and are separated from one another by a slash “/”. If the default setting is to be used for individual columns, you still need to insert a slash.

  If, for example, you only want to modify the last two columns, specify the number (x) of the first column you would like to modify and list the respective CONTENTS_IDENTIFIERs for the subsequent columns.

  ```
  TOOL_IDENTIFIER = x=CONTENTS_IDENTIFIER / CONTENTS_IDEN-
  TIFIER / ..
  ```

Note

Using the COLUMN command, you can first define one column identically for all tools and then adapt it specifically for individual tools.

You can identify comments by a semicolon (;) symbol.

If errors occur during evaluation of the configuration file, refer to the TO_INI_F.LOG file for a description of the error. With the PCU 20 this file is located on drive I; with PCU 50 it is located in the F:\MMC0W32\TMP directory.

Identifier

The following tables provide a list of the SCREEN_, TOOL_ and CONTENTS_ identifiers available for defining the columns.

Table 8-7 SCREEN_IDENTIFIER

SCREEN_IDENTIFIER	Tool management list
TOOL_LIST	Tool list
TOOL_LIST_2ND_EDGE	Tool list, further cutting edges
TOOL_WEAR	Tool wear list
TOOL_WEAR_2ND_EDGE	Tool wear list, further cutting edges
TOOL_MAGA	Magazine list
TOOL_LIST_OEM	Additional list

Table 8-8 TOOL_IDENTIFIER

TOOL_IDENTIFIER	Tools
SHANK_END_CUTTER	(End) mill
POINTED_DRILL	(Twist) drill
TO_SCREW_TAP	Screw tap
END_MILL_CUTTER	Facing tool
ANGLE_HEAD_CUTTER	Angle head cutter
LOCATOR	Centering tool
EDGE_TRACER	Edge probe
3DTRACER	3D probe
3DCUTTER_110	Cylindrical die mill
3DCUTTER_111	Ball end mill
3DCUTTER_121	End mill with corner rounding
3DCUTTER_155	Truncated cone mill
3DCUTTER_156	Bevel cutter with corner rounding
3DCUTTER_157	Tapered die mill

Table 8-9 CONTENT_ID

CONTENT_ID	Parameter or property
EMPTY	Empty field
NOT_USED	Empty column
LENGTH	length
RADIUS	Radius
RADIUS_DIAM	Radius with possible diameter calculation
ANGLE	Angle
N	Number of teeth
SPINDLE	Spindle direction
COOL1	Cooling water 1
COOL2	Cooling water 2
MFCT1	Tool-specific function 1
MFCT2	Tool-specific function 2
MFCT3	Tool-specific function 3
MFCT4	Tool-specific function 4
DLENGTH	Wear length
DRADIUS	Wear radius
DRADIUS_DIAM	Wear radius with possible diameter calculation
T_OR_C	Method of wear monitoring
P_TIME	Tool life
PW_TIME	Prewarning limit for tool life
P_COUNT	Count
PW_COUNT	Pre-warning limit for count
P_WEAR	Wear
PW_WEAR	Prewarning limit for wear
T_LOCKED	Tool blocked
T_SIZE	Oversized tool, see also CONTENT_ID T_SIZE_LONG
T_FIXED	Tool in fixed location
P_LOCKED	Magazine location disabled
MAG_T_LOCKED	Display only: Tool blocked
MAG_T_SIZE	Display only: Oversized tool
MAG_T_FIXED	Display only: Tool in fixed location
H_NBR	H number of an ISO dialect program
TPC1	Parameter 1
TPC2	Parameter 2
TPC3	Parameter 3
TPC4	Parameter 4
TPC5	Parameter 5
TPC6	Parameter 6
TPC7	Parameter 7
TPC8	Parameter 8
TPC9	Parameter 9

Table 8-9 CONTENT_ID

CONTENT_ID	Parameter or property
TPC10	Parameter 10
T_SIZE_LONG	Tool size The parameter is now contained only in the additional tool list of ShopMill. Column heading: LROU Cursor text: Tool size Input: Number of adjacent half locations (maximum 7) to be blocked. The first half location is always the magazine location the respective tool is mounted in. The number of adjacent half locations is specified as a four-digit number. The first digit is the number of adjacent locations to the left, the second to the right, the third above and the fourth below. If T_SIZE is set for the tool (tool oversized), then T_SIZE_LONG is set to the default 2211. Requirement input: The tool must be located outside a magazine.
T_MAG_PLACE_TYPE	Magazine location type The parameter is now contained only in the additional tool list of ShopMill. Column heading: Location type Cursor text: Magazine location type Input: Number of the magazine location type Requirement input: The tool must be located outside a magazine.

Parameter “H number” will only be displayed if ShopMill is set up for ISO dialects (see Section 11.2 “ISO Dialects”).

Example

```
;Tool list
[TOOL_LIST]

;Standard values for columns
COLUMN1 = H_NBR
COLUMN2 = LENGTH
COLUMN3 = RADIUS_DIAM
COLUMN4 = EMPTY
COLUMN5 = EMPTY
COLUMN6 = SPINDLE
COLUMN7 = COOL1
COLUMN8 = COOL2
COLUMN9 = MFCT1
COLUMN10= MFCT2
COLUMN11= MFCT3
COLUMN12= MFCT4

;Deviations from standard values
SHANK_END_CUTTER = 5=N
POINTED_DRILL = 4=ANGLE
LOCATOR = 3=EMPTY / ANGLE
3DCUTTER_110 = 5=N
3DCUTTER_111 = 5=N
3DCUTTER_121 = 5=N
3DCUTTER_155 = 5=N
3DCUTTER_156 = 5=N
3DCUTTER_157 = 5=N
```

8.10.3 Define texts

Texts (softkey name and list header for custom lists, column headers and cursor texts for customized parameters) are assigned to specific text numbers in a text file.

The following syntax applies:
`Text number 0 0 "Text"`

The two parameters 2 and 3 separated by blanks are control characters for text output and must always be set to 0.

The parameter name can consist of three lines, each line has its own text number (see Table 8-10).

Table 8-10 Text assignment

Text type	Text number
3. Horizontal softkey	89923
List header	89924
Column header parameter TPC1	89925, 89926, 89927
Cursor text parameter TPC1	89931
Column header parameter TPC2	89928, 89929, 89930
Cursor text parameter TPC2	89932
Column header parameter TPC3	89953, 89954, 89955
Cursor text parameter TPC3	89965
Column header parameter TPC4	89937, 89938, 89939
Cursor text parameter TPC4	89949
Column header parameter TPC5	89940, 89941, 89942
Cursor text parameter TPC5	89950
Column header parameter TPC6	89943, 89944, 89945
Cursor text parameter TPC6	89951
Column header parameter TPC7	89956, 89957, 89958
Cursor text parameter TPC7	89966
Column header parameter TPC8	89946, 89947, 89948
Cursor text parameter TPC8	89952
Column header parameter TPC9	89959, 89960, 89961
Cursor text parameter TPC9	89967
Column header parameter TPC10	89962, 89963, 89964
Cursor text parameter TPC10	89968

Example:
`89924 0 0 "tool data"`

The texts must not exceed the following number of characters:
Softkey: 9
List header: 20
Column header parameter: 7
Cursor text parameter: 45

A line break in the softkey text can be made by inserting two consecutive blanks.

Note

Some texts are already set to defaults which you can change.

PCU 20

For the PCU 20 enter the texts and numbers in the ALUC.TXT text file. There is an ALUC.TXT text file in each language directory.

PCU 50

For the PCU 50 enter the texts and numbers in the F:\DH\CUS.DIR\ALUC_xx.COM text file. If the ALUC_xx.COM file does not exist, you need to create it in the CUS.DIR directory.
The texts are assigned to a language by means of the name of the text file. “xx” is replaced by one of the following codes in the text file name:

Table 8-11 Language assignment

Abbreviation xx	Language
gr	German
uk	English
fr	French
it	Italian
sp	Spanish
nl	Dutch
dk	Danish
fi	Finnish
bk	Swedish
pl	Polish
tr	Turkish
ch	Simplified Chinese
tw	Chinese (Traditional)
ko	Korean
hu	Hungarian
po	Brazilian Portuguese
ru	Russian
cz	Czech
yes	Japanese

In the F:\USER\MBDDE.INI or F:\OEM\MBDDE.INI file add the following line under section [TextFiles]:

```
UserZYK=F:\dh\cus.dir\aluc_
```

8.11 Importing tool data

You can import tool data that you have measured on an external tool presetting station directly into the tool management of ShopMill.

Store the tool data in an INI file.

The header in the file must be exactly as follows:

```
;TOOL MAGAZINE ZEROPOINT,TOOL=2,MAGAZINE=0,WO=0,BWO=0
```

However, you can change the values for “Tool” and “Magazine”.

Tool=1: Delete all existing tools in the tool management and replace with new tools.
Tool=2: Add new tool management tools
Magazine=0: Do not evaluate magazine location number ($TC_MPP6)
Magazine=1: Evaluate magazine location number ($TC_MPP6)

Note

Always keep to the precise order (including blanks) in the header. If you enter an incorrect header line, the INI file will be evaluated as a G code program on opening. Starting the program with “Cycle-Start” causes existing data in the tool management to be overwritten by the data contained in the program.

The tool data must be assigned to the following variables in the INI file. In this case:

x = tool number
y = tool edge number

Table 8-12 Variable assignment

Variable	Meaning	Value
$TC_TP1[x]	Duplo number	Number
$TC_TP2[x]	Tool name	Name
$TC_TP3[x]	Number of half locations to the left to be blocked for oversized tools.	ShopMill default setting 1 = Do not disable adjacent location or 2 = Disable half of adjacent location to left
$TC_TP4[x]	Number of half locations to the right to be blocked for oversized tools.	ShopMill default setting 1 = Do not disable adjacent location or 2 = Disable half of adjacent location to right
$TC_TP5[x]	Number of half locations above to be blocked for oversized tools.	ShopMill default setting 1 = Do not disable adjacent location
$TC_TP6[x]	Number of half locations below to be blocked for oversized tools.	ShopMill default setting 1 = Do not disable adjacent location
$TC_TP7[x]	Magazine location type	Number

Table 8-12 Variable assignment

Variable	Meaning	Value
$TC_TP8[x]	Tool status	Bit 1 = 1: Tool enabled Bit 2 = 1: Tool disabled Bit 4 = 1: Prewarn lim. reached Bit 6 = 1: Tool fixed-location-coded
$TC_TP9[x]	Tool monitoring	Bit 0 = 1: Tool life monitoring on Bit 1 = 1: Workpiece count monitoring ON Bit 2 = 1: Wear monitoring ON
$TC_TPC1[x]	User-defined parameter 1	
$TC_TPC2[x]	User-defined parameter 2	
$TC_TPC3[x]	User-defined parameter 3	
$TC_TPC4[x]	User-defined parameter 4	
$TC_TPC5[x]	User-defined parameter 5	
$TC_TPC6[x]	User-defined parameter 6	
$TC_TPC7[x]	User-defined parameter 7	
$TC_TPC8[x]	User-defined parameter 8	
$TC_TPC9[x]	User-defined parameter 9	
$TC_TPC10[x]	User-defined parameter 10	
$TC_DP1[x,y]	Tool type	110: Cylindrical die mill 111: Ball end mill 120: End mill 121: End mill with corner rounding 130: Angle head cutter 140: Facing tool 155: Bevel cutter 156: End mill with corner rounding 157: Tapered die mill 200: Spiral drill 220: Centering tool 240: Tap 710: 3D probe 711: Edge probe
$TC_DP3[x,y]	Length	Number [mm]
$TC_DP4[x,y]	Length 2	Number [mm]
$TC_DP5[x,y]	Length 3	Number [mm]
$TC_DP6[x,y]	Radius or internal radius (facing tool)	Number [mm] Number [mm]
$TC_DP7[x,y]	Rounding radius or external radius (facing tool)	Number [degrees] Number [degrees]
$TC_DP11[x,y]	Angle for tapered tools or tool angle/bevel angle (facing tool)	Number [degrees] Number [degrees]
$TC_DP12[x,y]	Wear length	Number [mm]
$TC_DP13[x,y]	Wear length 2	Number [mm]
$TC_DP14[x,y]	Wear length 3	Number [mm]
$TC_DP15[x,y]	Wear radius	Number [mm]

Table 8-12 Variable assignment

Variable	Meaning	Value
$TC_DP24[x,1] $TC_DP24[x,y]	Number of teeth (milling cutter) or Angle tool point (drill)	Number Number [degrees]
$TC_DP25[x,1]	Direction of spindle rotation Coolant M function	Bit 8 and bit 9 = 0: Spindle stop Bit 8 = 1: Spindle clockwise Bit 9 = 1: Spindle counterclockwise Bit 10 = 1: Cooling water 1 on Bit 11 = 1: Cooling water 2 on Bit 0 = 1: M function 1 Bit 1 = 1: M function 2 Bit 2 = 1: M function 3 Bit 3 = 1: M function 4
$TC_DPH[x,y]	H number of an ISO dialect program	Number
$TC_MOP1[x,y]	Prewarning limit for tool life	Number [min]
$TC_MOP2[x,y]	Tool life	Number [min]
$TC_MOP3[x,y]	Pre-warning limit for count	Number
$TC_MOP4[x,y]	Count	Number
$TC_MOP5[x,y]	Prewarning limit for wear	Number [mm]
$TC_MOP15[x,y]	Maximum wear	Number [mm]
$TC_MPP6[n,m]	Magazine location number	Number n: Magazine number m: Magazine location number

You must specify a hexadecimal value for bit-coded parameters.

The H number for ISO dialect programs will only be evaluated if ShopTurn is set up for ISO dialects (see Section 11.2 “ISO Dialects”).

If you do not define parameters, the tool management will set them to zero later.

You must program the command “M30” at the end of the file.

For information about reading in tool data to the tool management, please refer to:
References: /BAS/, ShopMill Operating/Programming Guide

Example

```
;TOOL MAGAZIN ZEROPOINT,TOOL=2,MAGAZIN=0,NPV=0,BNPV=0
$TC_TP1[1]=1                ;Duplo number
$TC_TP2[1]=Mill             ;Tool "mill"
$TC_TP3[1]=1                ;Left adjacent location free
$TC_TP4[1]=1                ;Right adjacent location free
$TC_TP5[1]=1                ;Upper adjacent location free
$TC_TP6[1]=1                ;Lower adjacent location free
$TC_TP7[1]=1                ;Magazine location type
$TC_TP8[1]=2                ;Enable tool
$TC_TP9[1]=1                ;Tool life monitoring
$TC_DP1[1,1]=120            ;Tool type end mill
$TC_DP3[1,1]=120.41         ;Length
$TC_DP6[1,1]=5              ;Radius
$TC_DP24[1,1]=3             ;Number of teeth
...
M30                         ;End of program
```

■

9 Additional Functions

9.1 Measuring Cycles

9.1.1 Brief Description

Overview

You can use measuring cycles for automatic measuring on vertical machining centers and universal milling machines with ShopMill.

This is achieved simply by connecting a touch trigger probe to the control.

Measuring Cycles

The measuring cycles are shipped with ShopMill and contained in the ShopMill Toolbox.

You have to adapt the measuring cycle data to the specific characteristics of the machine.

9.1.2 Probe connection

Connection

You can connect up to two probes to the SINUMERIK 810D/840D/840Di via the X121 I/O interface.

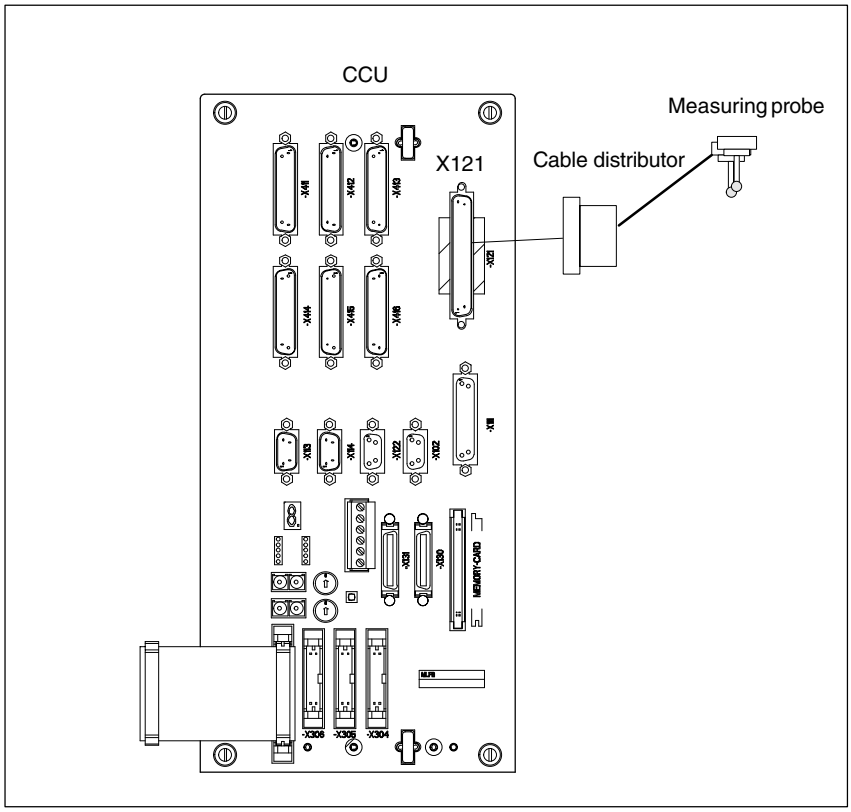


Fig. 9-1 Example: Probe connection to X121 on CCU module

I/O interface (X121)

The probe is connected via a 37-pin D-Sub connector (X121).

The 24 V load power supply is also connected by means of this connector.

Table 9-1 Extract from PIN assignment table for X121 front connectors

PIN		Designation
		External power supply
1	M24EXT	External ground
2	M24EXT	External ground
...	...	...
		Connection of probe 1
9	MEPUS 0	Measuring pulse signal input
10	MEPUC 0	Measuring pulse common input
...	...	...
		External power supply

Table 9-1 Extract from PIN assignment table for X121 front connectors

PIN		Designation
20	P24EXT	P 24 V external
21	P24EXT	P 24 V external
...	...	...
28	MEPUS 1	Connection of probe 2 Measuring pulse signal input
29	MEPUC 1	Measuring pulse common input
...	...	...

9.1.3 Function test

Measure command

The measuring cycles work internally with the MEAS command.

References: /PGA/, Programming Guide

PLC service display

The function test of the probe is conducted using a part program.

The measuring signal can be controlled via the diagnostics menu “PLC status”.

Table 9-2 Status display for measurement signal

	Status display
Probe 1 deflected	DB10 DB B107.0
Probe 2 deflected	DB10 DB B107.1

DB10,... **DBX107.0 and 107.1** Data Block	**Probe actuated** Signal(s) from axis/spindle (drive_PLC)		
Edge evaluation: no	Signal(s) updated: Cyclic	Signal(s) valid as of SW version 1.1	
Signal state 1 or signal transition 0 ——> 1	Probe 1 or 2 is actuated.		
Signal state 0 or signal transition 1 ——> 0	Probe 1 or 2 is not actuated.		
References	/PHD/, NCU 571-573 Manual /PHF/, NCU 570 Manual		
Note	The above mentioned signal states correspond to the default setting (non-deflected state 0V; deflected state 24V). In other cases, the measurement input number must be entered as a negative value.		

Example of functional check

```
%_N_TEST_PROBE_MPF
;$PATH=/_N_MPF_DIR
;Testing program probe connection
N05  DEF INT MTSIGNAL              ;Marker for
                                   ;activation state

N10  DEF INT ME_NR=1               ;Measuring input number
N20  DEF REAL MESSWERT_IN_X
N30  G17 T1 D1                     ;Select tool offset for
                                   ;probe
N40  _ANF: G0 G90 X0 F150          ;Starting position and
                                   ;measuring velocity
N50  MEAS=ME_NR G1 X100            ;Measurement at measuring
                                   ;input 1 in the X axis
N60  STOPRE
N70  MTSIGNAL=$AC_MEA[1]           ;Read software
                                   ;switching signal
                                   ;at 1st measurement input
```

```
N80  IF MTSIGNAL == 0 GOTOF _FEHL1 ;Evaluation of the signal
N90  MESSWERT_IN_X=$AA_MW[X]       ;Import measured value in
                                   ;workpiece coordinates
N95  M0
N100 M02
N110 _FEHL1: MSG (”Probe does not switch!”)
N120 M0
N130 M02
```

9.1.4 Start-up of probe

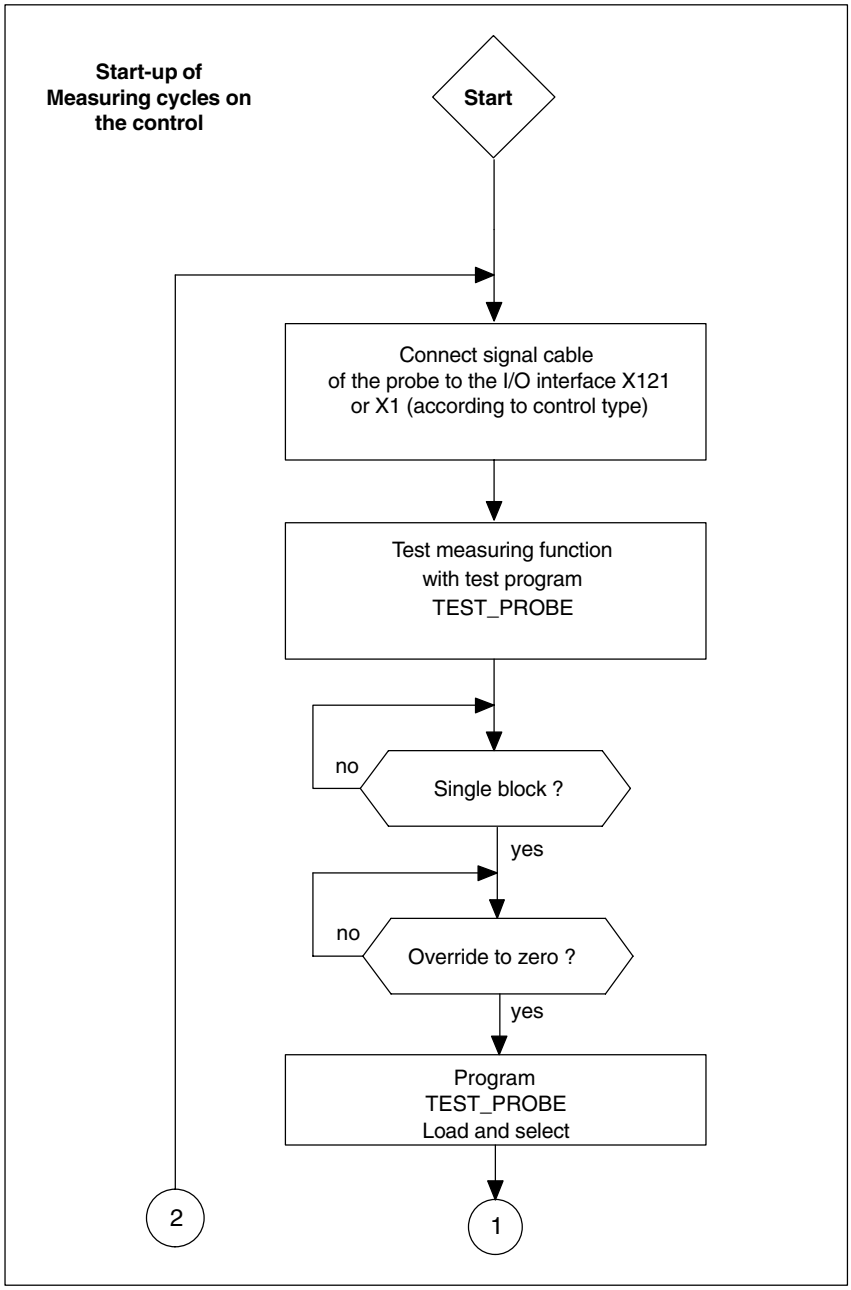


Fig. 9-2 Start-up flowchart – Part 1

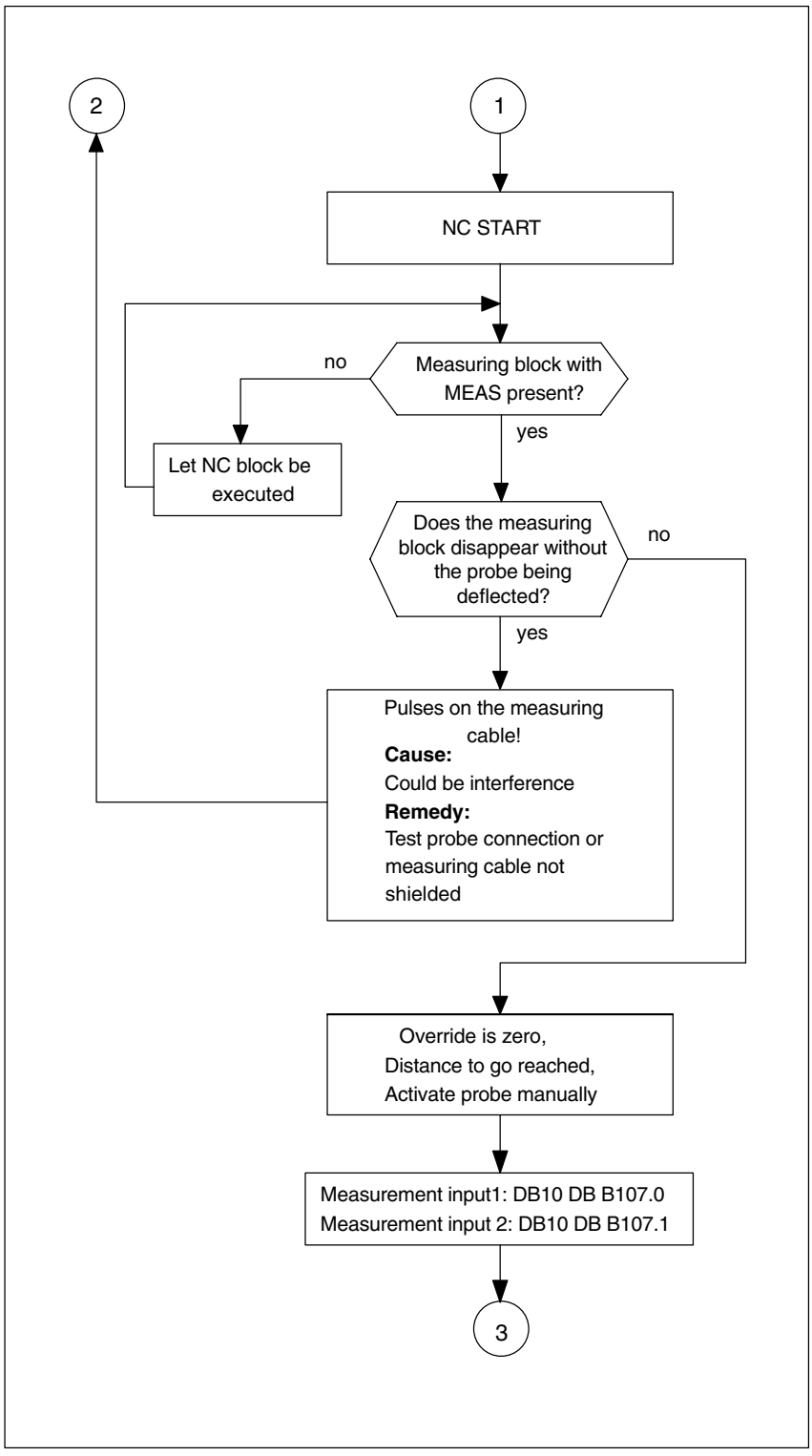


Fig. 9-3 Start-up flowchart – Part 2

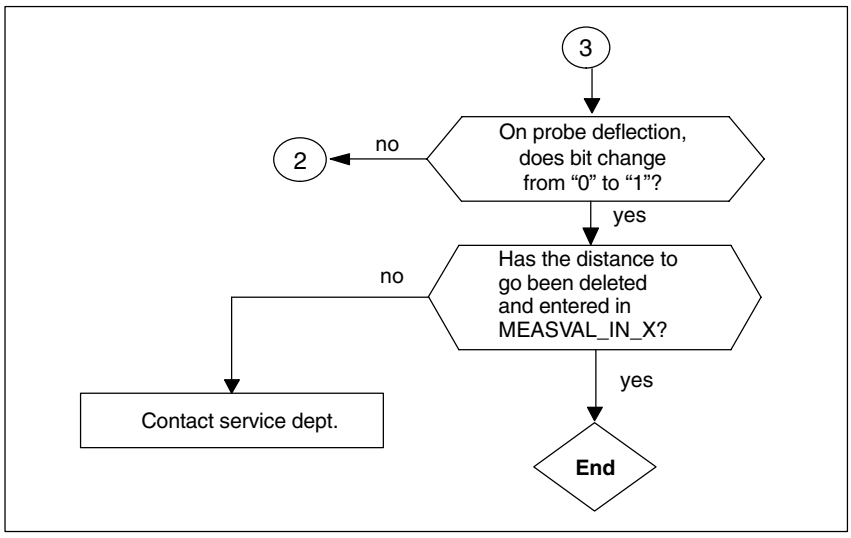


Fig. 9-4 Start-up flowchart – Part 3

9.1.5 Machine data measuring cycles

Machine data for adapting probe

13200 MD number	**MEAS_PROBE_LOW_ACTIVE[0]** Switching behavior of probe at measuring input 1		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after POWER ON	Protection level: 2/7	Unit: –	
Data type: BOOLEAN	Applies from SW version: 840D SW 4.3, 810D SW 2.3		
Meaning:	Value 0: (Default setting) Non-deflected state 0 V Deflected state 24 V Value 1 Non-deflected state 24 V Deflected state 0 V		

13200 MD number	**MEAS_PROBE_LOW_ACTIVE [1]** Switching behavior of probe at measuring input 2		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 1	
Changes effective after POWER ON	Protection level: 2/7	Unit: –	
Data type: BOOLEAN	Applies from SW version: 840D SW 4.3, 810D SW 2.3		
Meaning:	Value 0: (Default setting) Non-deflected state 0 V Deflected state 24 V Value 1 Non-deflected state 24 V Deflected state 0 V		

9.1.6 Display machine data measuring cycles

9747 MD number	CMM_ENABLE_MEAS_AUTO Enable automatic workpiece measurement		
Default setting: 1	Minimum input limit: 0	Maximum input limit: 1	
Changes effective as from NOW	Protection level: 3/4	Unit: –	
Data type: BYTE	Valid as of software version: ShopMill 6.4		
Meaning:	This MD enables the “Automatic workpiece measurement” function on the user interface. 0 = “Automatic workpiece measurement” function is not displayed 1 = “Automatic workpiece measurement” function is displayed.		

9749 MD number	CMM_ENABLE_MEAS_T_AUTO Enable automatic tool measurement		
Default setting: 1	Minimum input limit: 0	Maximum input limit: 1	
Changes effective as from NOW	Protection level: 3/4	Unit: –	
Data type: WORD	Valid as of software version: ShopMill 6.3		
Meaning:	This MD enables the “Automatic tool measurement” function on the user interface. 0 = “Automatic tool measurement” function is not displayed 1 = “Automatic tool measurement” function is displayed		

9750 MD number	CMM_MEAS_PROBE_INPUT Measuring input for workpiece probe		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 1	
Changes effective as from NOW	Protection level: 3/4	Unit: –	
Data type: BOOL	Valid as of software version: ShopMill 4.3		
Meaning:	This MD defines the measurement input for a workpiece probe. 0 = measurement input 1 is activated 1 = measurement input 2 is activated		

9751 MD number	CMM_MEAS_T_PROBE_INPUT Measuring input for tool probe		
Default setting: 1	Minimum input limit: 0	Maximum input limit: 1	
Changes effective as from NOW	Protection level: 3/4	Unit: –	
Data type: BOOL	Valid as of software version: ShopMill 4.3		
Meaning:	This MD defines the measurement input for a tool probe. 0 = measurement input 1 is activated 1 = measurement input 2 is activated		

9752 MD number	CMM_MEASURING_DISTANCE Max. measurement distance for workpiece measurement in the program		
Default setting: 5	Minimum input limit: 0.01	Maximum input limit: 1000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	This MD defines the maximum measurement path before and after the expected switching position (workpiece edge) for measuring the workpiece in the program. If no switching signal is output within the range, the error message “Probe does not switch” is output.		

9753 MD number	CMM_MEAS_DIST_MAN Max. measurement distance of the workpiece measurement in manual mode		
Default setting: 10	Minimum input limit: 0.01	Maximum input limit: 1000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	This MD defines the maximum measurement path before and after the expected switching position (workpiece edge) for measuring the workpiece in manual mode. If no switching signal is output within the range, the error message “Probe does not switch” is output.		

9754 MD number	CMM_MEAS_DIST_TOOL_LENGTH Max. measurement path tool length rot. spindle		
Default setting: 2	Minimum input limit: 0.001	Maximum input limit: 1000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	This MD defines the maximum measurement path before and after the expected switching position (tool length) for measuring the tool length with rotating spindle. If no switching signal is output within the range, the error message “Probe does not switch” is output.		

9755 MD number	CMM_MEAS_DIST_TOOL_RADIUS Max. measurement path for tool radius for rotating spindle		
Default setting: 1	Minimum input limit: 0.001	Maximum input limit: 1000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	This MD defines the maximum measurement path before and after the expected switching position (tool radius) for measuring the tool radius with rotating spindle. If no switching signal is output within the range, the error message “Probe does not switch” is output.		

9756 MD number	CMM_MEASURING_FEED Measuring feed rate for workpiece measurement		
Default setting: 300	Minimum input limit: 10	Maximum input limit: 5000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm/min	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	With this MD, you specify the measuring feed for “Measure workpiece”.		

9757 MD number	CMM_FEED_WITH_COLL_CTRL Plane feed with collision monitoring		
Default setting: 1000	Minimum input limit: 10	Maximum input limit: 5000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm/min	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	To protect the probe, intermediate positions are approached with this feed in the plane as measuring blocks to monitor for collisions. This feed must be selected such that the maximum deflection of the probe is not exceeded should a collision occur.		

9758 MD number	CMM_POS_FEED_WITH_COLL_CTRL Infeed with collision monitoring		
Default setting: 1000	Minimum input limit: 10	Maximum input limit: 5000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm/min	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	To protect the probe, intermediate positions are approached with this feed in the tool axis as measuring blocks to monitor for collisions. This feed must be selected such that the maximum deflection of the probe is not exceeded should a collision occur.		

9759 MD number	CMM_MAX_CIRC_SPEED_ROT_SP Max. circumference velocity for tool measurement of rotating spindle		
Default setting: 100	Minimum input limit: 1	Maximum input limit: 200	
Changes effective as from NOW	Protection level: 3/4	Unit: m/min	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	This MD defines the maximum permissible circumferential velocity of the tools to be measured for tool measurement with rotating spindle. The permissible spindle speed for carrying out the tool measurement is calculated according to the MD.		

9760 MD number	CMM_MAX_SPIND_SPEED_ROT_SP Max. speed for tool measurement of rotating spindle		
Default setting: 1000	Minimum input limit: 100	Maximum input limit: 25000	
Changes effective as from NOW	Protection level: 3/4	Unit: rpm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	This MD defines the maximum permissible speed of the tools to be measured for tool measurement with rotating spindle.		

9761 MD number	CMM_MIN_FEED_ROT_SP Min. feed rate for workpiece measurement for rotating spindle		
Default setting: 10	Minimum input limit: 0.01	Maximum input limit: 1000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm/min	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	This MD defines the minimum feed rate for tool measurement with a rotating spindle. Tools which have a very large radius and require high precision would otherwise have a very small feed.		

9762 MD number	CMM_MEAS_TOL_ROT_SP Measuring accuracy of tool measurement for rotating. spindle		
Default setting: 0.01	Minimum input limit: 0	Maximum input limit: 1	
Changes effective as from NOW	Protection level: 3/4	Unit: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	This MD defines the desired measuring accuracy for tool measurement with a rotating spindle.		

9763 MD number	CMM_TOOL_PROBE_TYPE Tool probe type		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 999	
Changes effective as from NOW	Protection level: 3/4	Unit: –	
Data type: WORD	Valid as of software version: ShopMill 4.3		
Meaning:	This MD defines the type of tool probe. 0 = cube 101 = disk in XY (1st and 2nd geometry axis) 201 = disk in ZX (3rd and 1st geometry axis) 301 = disk in YZ (2nd and 3rd geometry axis)		

9764 MD number	CMM_TOOL_PROBE_ALLOW_AXIS Permissible axis directions of tool probe		
Default setting: 133	Minimum input limit: 0	Maximum input limit: 333	
Changes effective as from NOW	Protection level: 3/4	Unit: –	
Data type: WORD	Valid as of software version: ShopMill 4.3		
Meaning:	With this MD, you specify the permissible axes and axes directions in which the tool probe can measure. The number to be specified is made up of ZYX. The following attributes can be specified for each axis: 0 = not possible 1 = only in negative direction 2 = only in positive direction 3 = in both directions		
Application example:	Default setting 133 means, 1st number (1): Measurement in Z only possible in minus direction 2nd number (3): Measurement in Y possible in both directions 3rd number (3): Measuring in X possible in both directions		

9765 MD number	CMM_T_PROBE_DIAM_LENGTH_MEA Diameter of tool probe for length measurement		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 100000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	With this MD, you specify the effective diameter or the effective edge of the tool probe for the tool length measurement.		

9766 MD number	CMM_T_PROBE_DIAM_RAD_MEAS Diameter of tool probe for radius measurement		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 100000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	With this MD, you specify the effective diameter or the effective edge of the tool probe for the radius measurement.		

9767 MD number	CMM_T_PROBE_DIST_RAD_MEAS Infeed tool probe upper edge for radius measurement		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 100000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Meaning:	With this MD, you specify the distance between the tool probe upper edge and the tool lower edge for the radius measurement.		

9768 MD number	CMM_T_PROBE_APPROACH_DIR Plane approach direction for tool probe		
Default setting: –1	Minimum input limit: –2	Maximum input limit: 2	
Changes effective as from NOW	Protection level: 3/4	Unit: –	
Data type: BYTE	Valid as of software version: ShopMill 4.3		
Meaning:	This MD defines the approach direction in the plane in which the tool is traveling to the tool probe. –1 = 1st plane axis in minus direction +1 = 1st plane axis in plus direction –2 = 2nd plane axis in minus direction +2 = 2nd plane axis in plus direction		

9769 MD number	CMM_FEED_FACTOR_1_ROT_SP Feed rate factor 1 tool measurement for rotating sp.		
Default setting: 10	Minimum input limit: 0	Maximum input limit: 100	
Changes effective as from NOW	Protection level: 3/4	Unit: –	
Data type: DOUBLE	Valid as of software version: ShopMill 6.3		
Meaning:	This MD specifies the feed factor for the 1st measuring operation for tool measurement with rotating spindle. 0: Measurement only performed once >0: 1st measuring operation with measuring feed multiplied by feed factor 1 2nd measuring operation with measuring feed		

9770 MD number	CMM_FEED_FACTOR_2_ROT_SP Feed rate factor 2 tool measurement for rotating sp.		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 50	
Changes effective as from NOW	Protection level: 3/4	Unit: –	
Data type: DOUBLE	Valid as of software version: ShopMill 6.3		
Meaning:	This MD specifies the feed factor for the 2nd measuring operation for tool measurement with rotating spindle. This factor is only active if MD 9769 CMM_FEED_FACTOR_1_ROT_SP > 0. This feed rate factor must be smaller than the feed rate factor in MD 9769 CMM_FEED_FACTOR_1_ROT_SP. 0: Measurement only performed twice >0: 1st measuring operation with measuring feed multiplied by feed factor 1 2nd measuring operation with measuring feed multiplied by feed factor 2 3rd measuring operation with measuring feed		

9771 MD number	CMM_MAX_FEED_ROT_SP Max. feed for tool measurement of rotating spindle		
Default setting: 20	Minimum input limit: 1	Maximum input limit: 1000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm/min	
Data type: DOUBLE	Valid as of software version: ShopMill 6.3		
Meaning:	This MD defines the maximum feed rate for tool measurement with a rotating spindle.		

9772 MD number	CMM_T_PROBE_MEASURING_DIST Measurement path for tool measurement with stationary spindle		
Default setting: 5	Minimum input limit: 1	Maximum input limit: 1000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 6.3		
Meaning:	This MD defines the measurement path for tool measurement and probe calibration when the spindle is stationary.		

9773 MD number	CMM_T_PROBE_MEASURING_FEED Feed rate for tool measurement with stationary spindle		
Default setting: 300	Minimum input limit: 10	Maximum input limit: 5000	
Changes effective as from NOW	Protection level: 3/4	Unit: mm/min	
Data type: DOUBLE	Valid as of software version: ShopMill 6.3		
Meaning:	This MD defines the feed for tool measurement and probe calibration when the spindle is stationary.		

9774 MD number	CMM_T_PROBE_MANUFACTURER Tool probe type (manufacturer)		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 2	
Changes effective as from NOW	Protection level: 3/4	Unit: –	
Data type: WORD	Valid as of software version: ShopMill 6.3		
Meaning:	This MD defines the tool probe type and enables use of prepared offset tables of some tool probe models for tool measurement with rotating spindle. 0 = none specified 1 = TT130 Heidenhain 2 = TS27R Renishaw		

9775 MD number	CMM_T_PROBE_OFFSET Measurement result correction for tool measurement for rotating sp.		
Default setting: 0	Minimum input limit: 0	Maximum input limit: 2	
Changes effective as from NOW	Protection level: 3/4	Unit: –	
Data type: WORD	Valid as of software version: ShopMill 6.3		
Meaning:	With this MD, you can activate a measuring result correction. This correction may be necessary if the tool probe switches differently at different rotation speeds of the tool being measured. 0 = no correction 1 = correction by prepared offset tables (for TT130 Heidenhain or TS27R Renishaw) 2 = correction via user-defined offset tables (see /BNM/, Measuring Cycles User Manual, _MT_EC_R[ ] and _MT_EC_L[ ]) (User-defined correction is performed if MD 9774 CMM_T_PROBE_MANUFACTURER = 1 or 2)		

9776 MD number	CMM_MEAS_SETTINGS Settings for measuring cycles		
Default setting: 0	Minimum input limit: –	Maximum input limit: –	
Changes effective as from NOW	Protection level: 3/4	Unit: –	
Data type: WORD	Valid as of software version: ShopMill 6.3		
Meaning:	Bit 0 = 0: During workpiece measurement and calibration of the workpiece probe, the spindle is automatically rotated to a defined starting position. (The starting position is determined automatically from the rotation of the workpiece coordinate system around the tool axis so that the same point on the probe sphere always points in the positive direction of the 1st axis of the plane of this coordinate system (for G17 in X)). Bit 0 = 1: During workpiece measurement and calibration of the workpiece probe, the current spindle position is taken as the starting position for the measuring cycles.		

9.2 Network connection

9.2.1 General description

Option

The “Manage network/diskette drive” function is an option and can be ordered with order no. 6FC5 463-0FA03-0AA0.

Function

ShopMill can set up a network drive management function in the Program Manager operating area. You can use it to display directories and files

- that are on an internal drive, e.g. a diskette drive, or
- that are on an external drive (network link).

Note

Please note that directories on external drives can only be linked if they are “shared” directories.

A maximum of 5 softkeys are provided for this purpose on the horizontal softkey menu in the Program Manager operating area. The “NC” softkey (1st horizontal softkey) is preconfigured for a specific function and is used to display the directories and files on the NC and the data management directory on the hard disk. You are free to configure the other 4 softkeys (horizontal softkeys 2 to 5) as you wish.

Note

If the “Part programs” and “Subroutines” directories in the Program Manager are enabled (MD 9719 $MM_CMM_OPTION_MASK), horizontal softkeys 4 to 7 become the 4 freely configurable softkeys.

Note

If errors arise in the network connection after you have performed the following steps for integration, the cause may lie in insufficient authorization (see 11.1.4 Machine Data for Protection Levels).

To install the network, please see

References: /IAM/, IM2, Installation and Startup HMI Embedded
IM4, Installation and Startup HMI Advanced

9.2.2 Integrating Windows network drives in ShopMill (PCU 20)

To integrate the Windows network drives, proceed as follows:

Switch to the CNC-ISO operator interface and select the “Startup” → “Logical drives” → “Connections” menu options.

In the first line of the “Network connections” window, enter the drive path and softkey text for the 2nd horizontal softkey in the ShopMill Program Manager. The entries for the remaining softkeys are made in the lower lines.

Enter drive paths

Enter the drive path in the left-hand input field.

For internal drives, you will have to enter the drive letter and, if required, the path.
Example: A:\SM

You must specify the complete network path (\\Computer Name\Share-Name\PathName) for external drives (the path name is optional).
Example: \\R4711\WORKPIECES\TEMPLATE
The directories (workpieces and templates) must be stored on the network computer (R4711).

Define softkey texts

Enter the softkey label on the right of the “Network connections” window. There is a separate input field for each line of the softkey. You can enter up to 6 characters per line (softkey with pictogram) or 9 characters (softkey without pictogram).

Note

With the PCU 20 you can also integrate the Compact Flash Card as network drive. Drive letter “C:” is assigned to the Compact Flash Card.

9.2.3 Integrating Windows network drives in ShopMill (PCU 50)

To integrate the Windows network drives, proceed as follows:

Define softkey texts

In the F:\DH\CUS.DIR\ALUC_xx.COM text file, enter the drive name for the 2nd to 5th softkey in the horizontal softkey bar. You may need to create the ALUC_xx.COM file in the CUS.DIR directory.

The following syntax applies:
`Text number 0 0 "Softkey text"`

The softkeys are assigned to the following text numbers in file ALUC_xx.COM:
Softkey2: 89901
Softkey3: 89902
Softkey4: 89903
Softkey5: 89904

The two parameters 2 and 3 separated by blanks are control characters for text output and must always be set to 0.

Note

A line break in the softkey text can be made by inserting two consecutive blanks. You can enter up to 6 characters per line (softkey with pictogram) or 9 characters (softkey without pictogram).

The text language is assigned on the basis of the text file name. “xx” is replaced by one of the following codes in the text file name:

Table 9-3 Language assignment

Abbreviation xx	Language
gr	German
uk	English
fr	French
it	Italian
sp	Spanish
nl	Dutch
dk	Danish
fi	Finnish
bk	Swedish
pl	Polish
tr	Turkish
ch	Simplified Chinese
tw	Chinese (Traditional)
ko	Korean

Table 9-3 Language assignment

Abbreviation xx	Language
hu	Hungarian
po	Brazilian Portuguese
ru	Russian
cz	Czech
yes	Japanese

In the F:\USER\MBDDE.INI or F:\OEM\MBDDE.INI file add the following line under section [TextFiles]:
`UserZYK=F:\dh\cus.dir\aluc_`

If file MBDDE.INI does not exist in the specified directory, you will have to create it first.

Example

In the Program Manager of ShopMill, the 2nd horizontal softkey must be assigned the name “NETZ1” in German.

You must make the following entry in text file ALUC_GR.COM:
`89901 0 0 "NETZ1"`

Enter drive paths

Enter the drive path of the relevant softkey in display MD 9676 to 9679.

The following display machine data are available:
Softkey2: MD 9676 $MM_CMM_DIRECTORY_SOFTKEY_PATH1
Softkey3: MD 9677 $MM_CMM_DIRECTORY_SOFTKEY_PATH2
Softkey4: MD 9678 $MM_CMM_DIRECTORY_SOFTKEY_PATH3
Softkey5: MD 9679 $MM_CMM_DIRECTORY_SOFTKEY_PATH4

The display machine data are described in Chapter 6 “Machine Data”.

You must enter the drive letter and the path (if desired) for internal drives.
You must specify the complete network path (\\COMPUTER NAME\SHARENAME\PATHNAME) for external drives (the path name is optional).

Example

You want to display directory Workpieces\Templates, which is stored on computer R4711, via the 2nd horizontal softkey named “NET1”.

The following must be entered in MD 9676: \\R4711\WERKSTUECKE\MUSTER

You want to display the SM directory on the disk drive via the 3rd horizontal softkey.

The following must be entered in MD 9677: A:\SM

9.3 Cylinder surface transformation

9.3.1 Function

Option

The cylinder surface transformation function can be used only if “Tracyl” (optional) has been set as a standard function.
The order number is: 6FC5 251-0AB01-0AA0.

General

The cylinder surface transformation is required in order to machine the following:

- Longitudinal grooves on cylindrical bodies,
- Transverse grooves on cylindrical objects,
- Grooves with any path on cylindrical bodies.

The groove contour is programmed in relation to the **developed**, plane surface of the cylinder. The program can include line/circle, drilling or milling cycles or profiling (free contour programming).

There are two variants of cylinder surface transformation, i.e.

- with groove wall offset (ON)
- without groove wall offset (OFF)

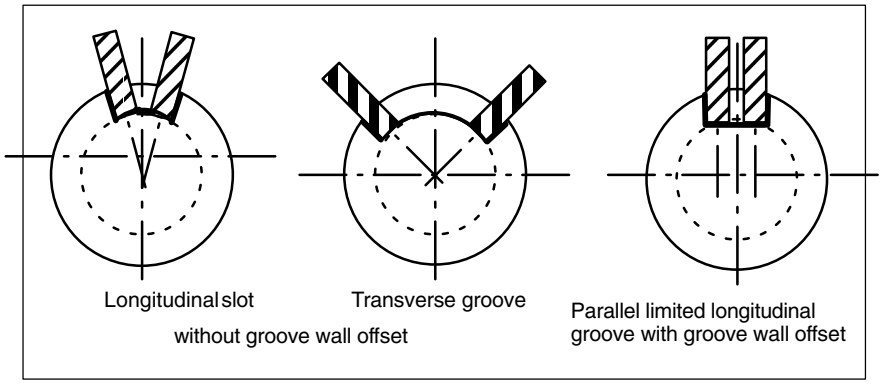


Fig. 9-5 Grooves with and without groove wall offset

Enable cylinder surface transformation

The “Enable cylinder surface transformation” function is displayed on the ShopMill operator interface when display MD 9721 $MM_CMM_ENABLE_TRACYL is set to 1. The rotary axis involved in the cylinder surface transformation is displayed and programmed via display MD 9653 $MM_CMM_ENABLE_A_AXIS or 9720 $MM_CMM_ENABLE_B_AXIS.

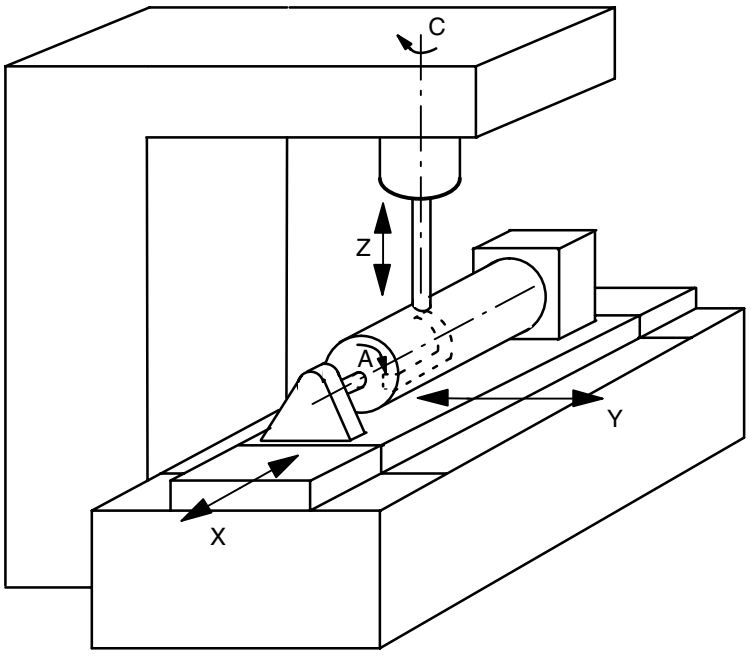
The cylinder surface transformation function is selected and deselected via “Miscellaneous”, “Transformations”, “Cylinder surface” softkey on the ShopMill Operator interface and is described in:

References: /BAS/, Operation/Programming ShopMill

9.3.2 Example of how to set an axis configuration

Example

The following example illustrates how to set the axis configuration on a machine.



Legend:

X	Axis parallel to rotary axis
Y	Supplementary axis
Z	Feed axis perpendicular to rotary axis
A	Rotary axis
C	Main spindle

Fig. 9-6 Machining grooves on a cylinder surface with X-C-Z kinematics

You must configure 2 data blocks with the following machine data for the machine illustrated above:

20070	$MC_AXCONF_MACHAX_USED[4]=5 Number of channel axes
20080	$MC_AXCONF_CHANAX_NAME_TAB[0]="XC" Channel axis XC
20080	$MC_AXCONF_CHANAX_NAME_TAB[1]="YC" Channel axis YC
20080	$MC_AXCONF_CHANAX_NAME_TAB[2]="ZC" Channel axis ZC
20080	$MC_AXCONF_CHANAX_NAME_TAB[3]="A" Channel axis A
20080	$MC_AXCONF_CHANAX_NAME_TAB[4]="C" Channel axis C

General settings for the transformations:
10602 $MN_FRAME_GEOAX_CHANGE_MODE=1

1. Data set for cylinder surface transformation without groove wall offset:
24100 $MC_TRAFO_TYPE_1=**512**
Definition of the 1st transformation in the channel cylinder surface
24110 $MC_TRAFO_AXES_IN_1[0]=3
Channel axis radial rotary axis (Z) for 1st transformation
24110 $MC_TRAFO_AXES_IN_1[1]=4
Channel axis der rotary axis for 1st transformation
24110 $MC_TRAFO_AXES_IN_1[2]=1
Channel axis parallel rotary axis (X) for 1st transformation
24110 $MC_TRAFO_AXES_IN_1[3]=2
Channel axis special axis Index [0] for 1st transformation
24120 $MC_TRAFO_GEOAX_ASSIGN_TAB_1[0]=1
1st channel axis (X) for 1st transformation
24120 $MC_TRAFO_GEOAX_ASSIGN_TAB_1[1]=4
2nd channel axis (Y) for 1st transformation
24120 $MC_TRAFO_GEOAX_ASSIGN_TAB_1[2]=3
3rd channel axis (Z) for 1st transformation
24800 $MC_TRACYL_ROT_AX_OFFSET_1=0
Offset der rotary axis for the 1st TRACYL transformation
24805 $MC_TRACYL_ROT_AX_FRAME_1=1
Axial offset of the rotary axis is considered during TRACYL
24810 $MC_TRACYL_ROT_SIGN_IS_PLUS_1=1
Sign of the rotary axis for the 1st TRACYL transformation
24820 $MC_TRACYL_BASE_TOOL_1[n]=0
Vector of the basic tool for the 1st TRACYL transformation

2. Data set for cylinder surface transformation without groove wall offset:
24200 $MC_TRAFO_TYPE_2=**513**
Definition of the 2nd transformation in the channel cylinder surface with groove wall offset
24210 $MC_TRAFO_AXES_IN_2[0]=3
Channel axis radial rotary axis (Z) for 2nd transformation
24210 $MC_TRAFO_AXES_IN_2[1]=4
Channel axis der rotary axis for 2nd transformation
24210 $MC_TRAFO_AXES_IN_2[2]=1
Channel axis parallel rotary axis (X) for 2nd transformation
24210 $MC_TRAFO_AXES_IN_2[3]=2
Channel axis special axis Index [0] for 2nd transformation
24220 $MC_TRAFO_GEOAX_ASSIGN_TAB_2[0]=1
1st channel axis (X) for 2nd transformation
24220 $MC_TRAFO_GEOAX_ASSIGN_TAB_2[1]=4
2nd channel axis (Y) for 2nd transformation
24220 $MC_TRAFO_GEOAX_ASSIGN_TAB_2[2]=3
3rd channel axis (Z) for 2nd transformation
24850 $MC_TRACYL_ROT_AX_OFFSET_2=0
Offset der rotary axis for the 2nd TRACYL transformation
24855 $MC_TRACYL_ROT_AX_FRAME_2=1
Axial offset of the rotary axis is considered during TRACYL
24860 $MC_TRACYL_ROT_SIGN_IS_PLUS_2=1
Sign of the rotary axis for the 2nd TRACYL transformation
24870 $MC_TRACYL_BASE_TOOL[n]=0
Vector of the basic tool for the 2nd TRACYL transformation

Note

For both data blocks, you can use any transformations from all available transformations (24100 $MC_TRAFO_TYPE_1, 24200 $MC_TRAFO_TYPE_2 etc.). The two data blocks need not be directly next to each other. However, the 1st data block must always be used for “Cylinder surface transformation without groove side offset” (= 512) and the 2nd data block for “Cylinder surface transformation with groove side offset” (=513).

9.4 Swivel heads and tables

Swivel heads and tables are employed to create or machine oblique surfaces.

Display MD 9723 $MM_CMM_ENABLE_SWIVELLING_HEAD is set to enable the swiveling function.

You must set up a swivel data set for every swivel head, swivel table or combination of both.

You can define swivel data sets using the “Swivel cycle” softkey in the “Start-up” operating area on the CNC-ISO operator interface.

User-specific customizations of the swivel function can be performed in the TOOLCARR swivel cycle.

A detailed description of the start-up (defining swivel data blocks and adapting the TOOLCARR swivel cycle) can be found in:
References: /PGZ/, Programming Guide Cycles

Alarms

When the swivel head/table is set manually, alarms displaying the required angle are output:
62180 set both axes manually
62181 set one axis manually

With a Hirth tooth system, the corresponding rotary axes can only assume certain positions (angle grid > 0). If the programming requires a position deviation from the angle grid, the machine automatically sets the nearest position and displays an alarm.
112328 Angle adapted to angle grid
In the TOOLCARR swivel cycle, it is possible to set how the alarm must be acknowledged.

If an angle of the swivel head/table is required to machine the workpiece that is outside the permissible angle range, an alarm is output:
61184 No solution possible with the current angle values
The programmed machining sequence cannot be performed with the existing swivel head/table.

In the case of manual loading/unloading or changing of swivel heads, ShopMill outputs the following alarms:
112323 Unload swivel head
112324 Load swivel head
112325 Replace swivel head
Otherwise, the TOOLCARR swivel cycle is called on loading/unloading swivel heads.

9.5 Multiple clamping

The “Multiple clamping” function optimizes tool changes 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 run the same program several times on the clampings or you can select different programs.
The “Multiple clampings with different programs” function is a software option and can be ordered with order no. 6FC5 463-0FA04-0AA0.

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).

Please proceed as follows:

- Change the CLAMP.SPF cycle that is stored on the Toolbox under TOOLS\DISK01\CYCLES\xxx.
- Copy the cycle into the directory user or manufacturer cycles.

Example

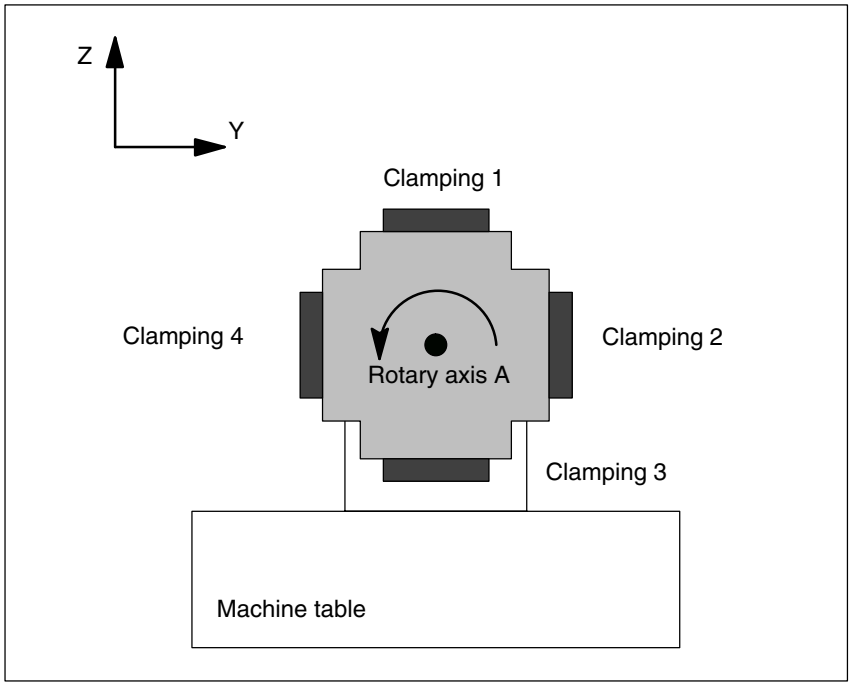


Fig. 9-7 Rotating clamping device (reversible clamping device)

In the example, a rotating clamping device (reversible clamping device) is used with 4 clampings. By positioning the rotary axis A, the clampings can each be machined.

Clamping 1 A = 0°
Clamping 2: A = 90°
Clamping 3: A = 180°
Clamping 4: A = 270°

The cycle CLAMP.SPF must be adapted as follows:

```
...
DEF INT _NV                    ; Auxiliary variable
;-------------------------------------
;Adjustment
;
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                   ; No calculation permitted here
RET
```

9.6 Measuring cycle support in the G code editor

In ShopMill you can integrate screen forms which provide support for programming measuring cycles into the G code editor. These cycles can then be recompiled automatically.

The “measuring cycles” function is a software option with order no. 6FC5 250-0BX00-0AB0.

For more information on measuring cycle support please refer to:
References: /BNM/, Measuring Cycles User Manual

Proceed as follows for start-up:

PCU 20

- Transfer the file TOOLS\DISK01\CYCLES\COMMON.COM to the NC. The file is automatically stored in the STANDARD_CYCLES directory.
- Remove the semicolon “;” in front of the following line in file STANDARD-ZYKLEN\COMMON.COM:
  ```
  ;sc8407=aeditor.com     ;Measuring cycles milling (horizontal softkey 7
                          ;On the extended softkey bar in the
                          ;G code editor)
  ```
  This makes the link between the softkey with which you call the measuring cycle support and the configuration file of this support screenform.
- Remove the semicolon “;” in front of the following line in file STANDARD-ZYKLEN\COMMON.COM:
  ```
  ;sc617=startup.com      ;Start-up operating area (horizontal
                          ;softkey 7 on the extended softkey bar)
  ```
  This can change the properties of the measuring cycle support in the start-up operating area.
- Restart the PCU 20.
- If required, modify the characteristics for the measuring cycle support in the “Start-up” → “>” → “Measuring Cycles” menu.

PCU 50

Requirements:
At HMI Advanced start-up the files AEDITOR.COM and STARTUP.COM are stored in the STANDARD CYCLES (CST.DIR) directory.
The archive ST_CYC.ARC was transferred from the PCU 50 to the NC at start-up of ShopMill. The COMMON.COM file was automatically copied to the STANDARD_CYCLES directory (CST.DIR).

- Copy the archive MCSUPP from the ARCHIVES\ CYCLES-ARCHIVE\MCYC.
- If you want to use the measurement result displays, you need to copy the MCRESULT archive from the ARCHIVES\CYCLE_ARCHIVES\MCYC directory.
- If the versions of the standard measuring cycles supplied with ShopMill (see UPDATE_x.RTF file on the software CD) differ from the HMI Advanced measuring cycles (see ARCHIVES\CYCLE_ARCHIVES\MCYC\VERSION.ARC) in the first 4 digits (e.g. 06.02), you need to copy the MCYCMILL archive from the ARCHIVES\CYCLE_ARCHIVES\MCYC directory.
- Remove the semicolon ";" in front of the following line in file STANDARD-ZYKLEN\COMMON.COM:

```
;sc8407=aeditor.com    ;Measuring cycles milling (horizontal softkey 7
                       ;On the extended softkey bar in the
                       ;G code editor)
```

  Remove the semicolon ";" in front of the following line in file STANDARD-ZYKLEN\AEDITOR.COM:

```
;HS15=($83531,,se1)
;PRESS(HS15)
;  LS("F_mess","MZ_SKL.COM",1)
;END_PRESS
```

  This makes the link between the softkey with which you call the measuring cycle support and the configuration file of this support screenform.

- In the file STANDARD_CYCLES\STARTUP.COM remove the semicolon ";" preceding the following lines:

```
;HS15=($83070,,se1)
;PRESS(HS15)
;  LS("Messz")
;END_PRESS
```

  This allows you to modify the characteristics of the measuring cycle support in the Start-up operating area.
- Restart the PCU 50.
- If required, modify the characteristics for the measuring cycle support in the "Start-up" → ">" → "Measuring Cycles" menu.

■

Notes

Customer-Specific Operator Interface 10

10.1 Configuring the customized boot screen

10.1.1 PCU 20

You can create your own customized boot screen (company logo, etc.) which will be displayed when the control system is booted.

Please proceed as follows to configure the customized boot screen:

1. Create your own boot screen in 16-color mode. The maximum screen size is 224x224 pixels for the OP010/OP010C/OP010S/OP012 and 352x352 pixels for the OP015.
2. Save the boot screen in bitmap format under the name CUSTOM.BMP.
3. Start the APP_INST.EXE file (see Subsection 4.2.2 “Installing ShopMill on PCU 20”).
4. Select <2> “Modify configuration”.
5. Select <6> “Add user specific files to the application”.
6. Enter the path for file CUSTOM.BMP.
   The custom boot screen is added to the application software.
7. Return to the main menu with Esc.
8. Finish installing the software on the PC card (see Subsection 4.2.2 “Installing ShopMill on PCU 20”).
9. Load the PC card to the PCU 20 (see Subsection 4.2.2 “Installing ShopMill on PCU 20”).
10. Set MD 9675 $MM_CMM_CUSTOMER_START_PICTURE to the value 1.

10.1.2 PCU 50

You can create your own customized boot screen (company logo, etc.) which will be displayed when the control system is booted.

Please proceed as follows to configure the customized boot screen:

1. Create your own boot screen in 16-color mode. The maximum screen size is 224x224 pixels for the OP010/OP010C/OP010S/OP012 and 352x352 pixels for the OP015.
2. Save the boot screen in bitmap format under the name CUSTOM.BMP.
3. Copy the CUSTOM.BMP file to the F:\DH\CUS.DIR\HLP.DIR directory.
4. Set MD 9675 $MM_CMM_CUSTOMER_START_PICTURE to the value 1.

10.2 Configuring the custom screen form

You can use the “operator interface expansion” software to build your own custom screen forms with specific functional expansions (e.g. custom cycles and measuring cycles) or just create your own screen form layout (static screen forms).

References: /IAM/, Installation and Start-Up Guide HMI, BE1 User Interface Extension

Screen form properties

In ShopMill, you cannot specify any dimensions for configuration of the main part of the screen form. The position and size of the various form main parts are specified depending on the operating area and mode. This only applies for forms that can be accessed via entry softkeys.

Table 10-1 Specified dimensions of the forms in ShopMill

Exit screen form	Softkey	Size	Dimensions
Manual operating mode – Zero point workpiece / Measure workpiece	Vertical softkey 1 ... Vertical softkey 7		X-pos. = 0 Y-pos. = 272 height = 158 pixels width = 556 pixels
Manual operating mode	Horizontal softkey 8	large	X-pos. = 0 Y-pos. = 34 height = 396 pixels width = 556 pixels
Manual operating mode	Horizontal softkey 8	medium	X-pos. = 0 Y-pos. = 78 height = 352 pixels width = 556 pixels
Manual operating mode	Horizontal softkey 8	small	X-pos. = 0 Y-pos. = 254 height = 176 pixels width = 556 pixels
Automatic mode	Horizontal softkey 6	large	X-pos. = 0 Y-pos. = 34 height = 396 pixels width = 556 pixels
Automatic mode	Horizontal softkey 6	medium	X-pos. = 0 Y-pos. = 78 height = 352 pixels width = 556 pixels
Automatic mode	Horizontal softkey 6	small	X-pos. = 0 Y-pos. = 254 height = 176 pixels width = 556 pixels
Program operating area – Drilling / milling	Vertical softkey 6		X-pos. = 33 Y-pos. = 52 height = 378 pixels width = 523 pixels
Program operating area – Miscellaneous	Vertical softkey 4		X-pos. = 33 Y-pos. = 52 height = 378 pixels width = 523 pixels

Table 10-1 Specified dimensions of the forms in ShopMill

Exit screen form	Softkey	Size	Dimensions
Program operating area – G code editor	Horizontal softkey 2 ... Horizontal softkey 6		X-pos. = 0 Y-pos. = 34 height = 396 pixels width = 556 pixels
Alarms operating area	Horizontal softkey 7 Horizontal softkey 6		X-pos. = 0 Y-pos. = 34 height = 396 pixels width = 556 pixels
Tools/Zero Offsets operating area	Horizontal softkey 7		X-pos. = 0 Y-pos. = 34 height = 396 pixels width = 556 pixels

Generate code

Do not enter a target directory for the program operating area and the manual mode. ShopMill defines the target file.

Entry softkeys

The custom static screens can be displayed with the following entry softkeys, the SC number being the link between the entry softkey and the configuration file of the screen form.
In manual and automatic modes you have the choice between different sized forms that fill the following window areas:

- large: Status area, position display, or program display and input window
- medium: Position display or program display and input window
- small: Input window

Table 10-2 Entry softkeys for screen forms

Exit screen form	Softkey	Size	SCxxxx
Manual operating mode	Horizontal softkey 8	large	SC818
	Horizontal softkey 8	medium	SC8181
	Horizontal softkey 8	small	SC8182
Automatic mode	Horizontal softkey 6	small	SC826
	Horizontal softkey 6	medium	SC8261
	Horizontal softkey 6	large	SC8262
Messages/Alarms operating area	Horizontal softkey 7		SC857
Messages/Alarms operating area	Horizontal softkey 8		SC858
Tools/Zero Offsets operating area	Horizontal softkey 7		SC867

Note

The form size is fixed in ShopMill (see above “Form Properties”). Take note of this in case you would like to program background images, for example, for forms you configured yourself.

Note

Open a user-configured form before calling a softkey bar.

You can call your own cycles by means of the following access softkeys:

Table 10-3 Entry softkeys for cycles

Exit screen form	Softkey	SCxxxx
Program operating area – Drilling	Vertical softkey 6	SC8426
Program operating area – Milling	Vertical softkey 6	SC8436
Program operating area – Miscellaneous	Vertical softkey 4	SC8454

Note

In manual mode you can also assign a user cycle to horizontal softkey 8. The NC code generated is then collected and you can then start the cycle with “Cycle Start”.

You can use the following entry softkeys to reveal your own measuring cycles, which are to replace the ShopMill measuring cycles:

Table 10-4 Entry softkeys for measuring cycles

Exit screen form	Softkey	SCxxxx
Manual operating mode – Zero point workpiece	Vertical softkey 1	SC8131
Manual operating mode – Zero point workpiece	Vertical softkey 2	SC8132
Manual operating mode – Zero point workpiece	Vertical softkey 3	SC8133
Manual operating mode – Zero point workpiece	Vertical softkey 4	SC8134
Manual operating mode – Zero point workpiece	Vertical softkey 5	SC8135
Manual operating mode – Zero point workpiece	Vertical softkey 6	SC8136
Manual operating mode – Zero point workpiece	Vertical softkey 7	SC8137
Manual operating mode – Tool measurement	Vertical softkey 1	SC8141
Manual operating mode – Tool measurement	Vertical softkey 2	SC8142
Manual operating mode – Tool measurement	Vertical softkey 3	SC8143
Manual operating mode – Tool measurement	Vertical softkey 4	SC8144
Manual operating mode – Tool measurement	Vertical softkey 5	SC8145

Table 10-4 Entry softkeys for measuring cycles

Exit screen form	Softkey	SCxxxx
Manual operating mode – Tool measurement	Vertical softkey 6	SC8146
Manual operating mode – Tool measurement	Vertical softkey 7	SC8147
Operating area program – Miscellaneous – Zero point workpiece	Vertical softkey 1	SC8951
Operating area program – Miscellaneous – Zero point workpiece	Vertical softkey 2	SC8952
Operating area program – Miscellaneous – Zero point workpiece	Vertical softkey 3	SC8953
Operating area program – Miscellaneous – Zero point workpiece	Vertical softkey 4	SC8954
Operating area program – Miscellaneous – Zero point workpiece	Vertical softkey 5	SC8955
Operating area program – Miscellaneous – Zero point workpiece	Vertical softkey 6	SC8956
Operating area program – Miscellaneous – Zero point workpiece	Vertical softkey 7	SC8957
Operating area program – Miscellaneous – Tool measurement	Vertical softkey 1	SC8961
Operating area program – Miscellaneous – Tool measurement	Vertical softkey 2	SC8962
Operating area program – Miscellaneous – Tool measurement	Vertical softkey 3	SC8963
Operating area program – Miscellaneous – Tool measurement	Vertical softkey 4	SC8964
Operating area program – Miscellaneous – Tool measurement	Vertical softkey 5	SC8965
Operating area program – Miscellaneous – Tool measurement	Vertical softkey 6	SC8966
Operating area program – Miscellaneous – Tool measurement	Vertical softkey 7	SC8967

10.2.1 Transferring cycles to the machining plan

You can transfer all user cycles that you have inserted in the operating area program (including measuring cycles) to the machining plan and edit them there. However, the cycles will not be displayed as programming graphics.

Use the “operator interface extension” software to define the cycle. Please note that the cycle must contain the Generate Code (GC) function and an OUTPUT method for NC code to be generated and sent to the NC for execution.

If you call up and take over the cycle on the ShopMill operator interface, the cycle will automatically appear in the machining plan. The screen form name of the cycle will appear in the machining plan as plain text.

10.2.2 Linking cycles into the machining plan

You can link user cycles into the machining plan with the ShopMill “Positions” cycles.

Name

The name of the cycles to be linked in the work plan is mandatory and must not be changed:
E_DR_Ox with x = 1 to 9

Variables

The following variables must be configured within the cycles:

You must first define three variables which are not assigned until the program step is inserted in the machining plan, i.e. the attribute must be assigned invisibly (wr0) to the input field of each variable. The variable sequence is as follows:

1. Variable for the next tool, data type String (S)
2. Variable for the position identifier in objects, data type Integer
3. Variable for the sequencer text that is to be displayed in the ShopMill work schedule, data type character string (S)
   The easiest way to assign a value to this variable is in a LOAD method.

Two variables for cycles processing must also be defined as well as one variable for each toggle field which has a different display content on the interface (e.g. mm/rev) than the internally transferred quantity (e.g. 1).
You need to assign the attribute invisible (wr0) to these variables too as they do not have their own input field. You can place the variables in any order.

Note

When an OUTPUT method is used, all variables described above must be configured within this method so that they can all be interpreted on recompilation.

Example

Directory TOOLS\DISK01\CYCLES\xxx\OEM_1 in the tool box contains a sample cycle E_DR_O1.SPF. The associated operator interface is configured in the E_DR_O1.COM file. The German and English texts are stored in the E_DR_TXD.COM and E_DR_TXE.COM files respectively. A number of help displays are also included with the sample cycle.
Please see the README.TXT file for information on how to install the cycle.

10.2.3 Integrating measuring cycles

Manual operating mode

If you wish to integrate your own measuring cycles in Manual mode, vertical softkey 8 (VS8) in the new cycles screen acquires a special meaning. All actions that the new measuring cycle is supposed to perform after the “cycle start” key has been pressed must be defined in a PRESS method for VSK8. If you press the “cycle start” button, NC code is generated that is written and executed in a program, i.e. the Generate Code (GC) function must be programmed in the PRESS method for VSK8. This in turn means that an OUTPUT method must be defined.

Note

The user does not have to press VSK8; it is triggered internally when the “cycle start” key is pressed. It should therefore not be labeled.

Example

In the toolbox you will find the archive file E_MS_O1.ARC in directory TOOLS\DISK01\CYCLES\xxx\OEM_MEAS. This contains the example measuring cycle E_MS_O1.SPF. The associated operator interface is configured in the E_DR_O1.COM file. In Files E_MS_TXD.COM and E_MS_TXE.COM contain the German and English texts, and file EDGE_Z.BMP contains a help display. Please see the README.TXT file for information on how to install the cycle.

Program operating area

If you want to link user measuring cycles into the operating area program, proceed as described in Subsection 10.2.1 “Transferring Cycles to the Machining Plan”.
A vertical softkey menu will then be created behind the entry softkey “Miscellaneous” → “Zero point workpiece”, via which you can call up your measuring cycles. Such a vertical softkey menu already exists behind the “Miscellaneous” → “Measure tool” entry softkey.

10.3 ShopMill Open (PCU 50)

ShopMill Open has an extended basic menu bar. In ShopMill Open, the HMI Advanced operating areas “Parameter” (without tool management and zero offsets), “Services”, “Diagnosis” and “Startup” on the extended horizontal softkey bar.

The extended horizontal softkey bar also includes the “Machine Service” and “Exit” softkeys for start-up/diagnosis. These two softkeys are visible only when protection level 1 is selected.

In addition, in ShopMill Open you can integrate Windows applications in the standard menu bar via softkeys.
You must also install the Windows applications in the OEM directory and define them in the REGIE.INI file. This does not apply to Siemens additional products. You must install those in the ADD_ON directory. See the ShopMill CD-ROM:

References: User’s Guide HMI Programming Package Part 1 (BN)

10.3.1 Basic menu bar

Jump into application

There are various methods by which you can integrate Windows applications into the basic menu bar:

- Horizontal softkey 4, i.e. the Messages/Alarms operating area is replaced
- User-assignable softkeys 7 and 8
- User-assignable softkeys 1 to 8 in the extended horizontal softkey menu

Return

There are 3 methods by which you can jump from the Windows application to another operating area:

- Using the “Menu Select” key on the operator panel, you can return to the basic menu bar and then select another operating area via a softkey.
- You can configure the keys “Position”, “Program”, “Offset”, “Program Manager”, “Alarm” and “Custom” on the operator panel to branch directly into another operating area or sub-menu.
- You can configure so-called “PLC keys” to branch into another operating area or sub-menu.

References: /IAM/, Installation and Start-Up Guide HMI,
User Interface Extension (BE1)
Section on “OP Hotkeys and PLC Keys”

10.4 User status display (PCU 50)

You can display machine states controlled via the PLC as custom user icons in the program status line.

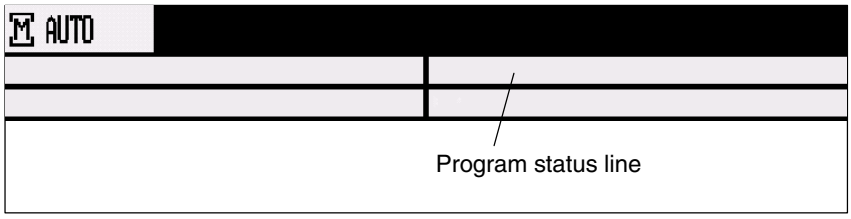


Fig. 10-1 Program status line

You need to activate the display of user icons in the display MD 9052 SHOW_CHANNEL_SPANNING_STATE.
The program path of the currently selected program is shown in the line below together with the program name.

16 display positions are defined in the program status line.

User symbols

The custom user icons must meet the following requirements:

- Colors: 16-color mode
- Size: OP010/OP010C/OP010S: 16 x 16 pixels
  OP012: 20 x 20 pixels
  OP015: 27 x 26 pixels (height x width)
- File name: 8 character
- Format: BMP

Place the user symbols in the F:\DH\CUS.DIR\HLP.DIR directory.

HEADER.INI

Enter the names of your custom user icons in the HEADER.INI in section `UserIcons` together with the signal for controlling symbol selection.

Note

If you have already made these entries for HMI Advanced, you do not have to repeat the entries for ShopMill.

```
[UserIcons]
UI_0= <Icons_00.bmp>, <Position>
                UI_0:           Identifier
                Icons_00.bmp:   Name of the user icon
                Position:       Position for display (1 to 16)
...
UI_31= <Icons_31.bmp>, <Position>
```

```
USER_ICON_BASE = DBx.DBBy
```

DBx.DBBy: Signal defined by user for controlling icon selection

You will find the HEADER.INI file in the F:\HMI_ADV directory and must copy them either to the F:\OEM or the F:\USER directory.

The user icons are addressed bit by bit, i.e. if bit **n** is set in signal DBx.DBBy, then the user icon with identifier UI_**n** is displayed.
If the bit is reset by the PLC, the associated user icon is deleted in the program status display.

If several user symbols are assigned to the same position, the user symbol with the highest identifier number is displayed.
You do not need to specify blank positions.

10.5 OP hotkeys, PLC keys

OP hotkeys

You can configure the keys “Position”, “Program”, “Offset”, “Program Manager”, “Alarm” and “Custom” on the operator panel to branch to an operating area of your choice.

PLC keys

You can configure so-called “PLC keys” to branch to particular operating areas.

Configuring

You can switch to the following operating areas with the OP hotkeys or PLC keys:

- PCU 20
  From ShopMill to any operating area of ShopMill.
- PCU 50
  From ShopMill to any other operating area in ShopTurn.
  From ShopMill to any other operating area in HMI Advanced and vice versa.

For information about how to configure the keys, please refer to:
References: /IAM/, Installation and Start-Up Guide HMI, User Interface Extension (BE1)
keyword “OP Hotkeys” and “PLC Keys”

Note

In ShopMill, the “PLC keys” are configured in file KEYS.INI, not via interface DB 19.
File KEYS.INI must contain the following entry in section [HMI_INI_FILES]:

```
Task6 = shopmill.ini
```

■

Notes

Miscellaneous

11

11.1 Access protection via password and keyswitch

11.1.1 General

Access rights

Access to programs, data and functions is useroriented and controlled via 8 hierarchical protection levels. These are divided into (see Table 12–1):

- 4 password levels for Siemens, machine manufacturer and end user
- 4 keyswitch positions for end user

This provides a multilevel safety concept for controlling access rights.

Table 11-1 Access security

Prot. level	Type	Users	Access to (examples)
0	Password	Siemens	All functions, programs and data
1	Password	Machine manufacturer: Development	Defined functions, programs and data; e.g.: enter options
2	Password	Machine manufacturer: Commissioner	Defined functions, programs and data; e.g.: majority of machine data
3	Password	End user: Service	Assigned functions, programs and data
4	Keyswitch pos. 3	End user: Programmer Machine setter	Less than protection level 0 to 3; defined by machine manufacturer or End user
5	Keyswitch pos. 2	End user: Qualified operator, who does not program	Less than protection level 0 to 3; defined by end user
6	Keyswitch pos. 1	End user: Trained operator, who does not program	Example: Only program selection, tool wear input and input of work offsets
7	Keyswitch pos. 0	End user: Trained operator	Example: No input or program selection possible, only machine control panel can be operated

Access protection system

- Protection level 0 provides the greatest number of access rights, protection level 7 the least.
- If certain access rights are granted to a protection level, these protection rights automatically apply to any higher protection levels.
- Conversely, protection rights for a certain protection level can only be altered from a higher protection level.
- Access rights for protection levels 0 to 3 are permanently assigned by Siemens and cannot be altered (default).
- Access authorization is set through scanning of the current keyswitch position and a comparison of password entries. When a password is entered it overwrites the access rights of the keyswitch position.
- Options can be protected on each protection level. However, option data can only be entered in protection levels 0 and 1.
- Access rights for protection levels 4 to 7 are merely suggested settings and can be altered by the machine tool manufacturer or end user.

11.1.2 Password

Set password

The passwords for the 4 available password levels with their respective access authorization can be entered in the DIAGNOSTICS operating area through selection of softkey SET PASSWORD.

References: /BEM/, Operator's Guide HMI Embedded or
/BAD/, Operator's Guide HMI Advanced

Reset password

Please note that a password remains valid until the access authorization is directly reset with the "Delete password" softkey.
Access authorization is therefore not automatically deleted during Power ON!

Possible characters

Up to 8 characters can be used in the password. We recommend that you restrict yourself to the character set of the operator panel in selecting a password. Where a password consists of less than eight characters, the additional characters are interpreted as blanks.

Default passwords

The following default passwords are defined for protection levels 1 to 3:

Protection level 1	SUNRISE
Protection level 2	EVENING
Protection level 3	CUSTOMER

Note

These passwords are entered as the defaults on system power-up in start-up mode (NCK start-up switch in position 1).

The default passwords should be changed in order to guarantee reliable access protection.

11.1.3 Keyswitch settings

Key switch

The keyswitch has four positions to which protection levels 4 to 7 are assigned. The keyswitch is operated by 3 colored keys that can be removed from the lock in different positions (see Table 11-2). The key positions can be assigned to functions by the machine tool manufacturer or end user. Access to programs, data and functions can be set in the machine data for each user (see Subsection 11.1.4 “Machine Data for Protection Levels”).

The keyswitch positions are transferred to the PLC interface (interface signals “Keyswitch positions 0 to 3” (DB10, DBX56.4 to 7) and can be evaluated by the PLC user program.
Keyswitch position 0 has access rights of the lowest priority and position 3 access rights of the highest priority. For example, all data that can be changed in keyswitch positions 0, 1 or 2 can also be changed in position 3.

Keyswitch applications

Access to certain data areas can be disabled with the keyswitch. Unintentional changes to geometry data (e.g. zero offsets) or activation of program control functions (e.g. selecting dry run feed rate) by the operator are therefore ruled out.

Table 11-2 Keyswitch setting 0 to 3

Switch position	Retraction pos.	DB10, DBB56	Protection level
Position 0 	–	Bit 4	7
Position 1 	0 or 1 Black key	Bit 5	6
Position 2 	0 or 1 or 2 Green key	Bit 6	5
Position 3 	0 or 1 or 2 or 3 Red key	Bit 7	4

Influencing the PLC user program

The PLC interface signals “Keyswitch positions 0 to 3” can be input either directly via the keyswitch on the machine control panel or from the PLC user program. Only one interface signal must be set. If several interface signals are set simultaneously, keyswitch position 3 is activated internally in the control.

11.1.4 Machine data for protection levels

Lockable data areas

The machine manufacturer or end user can set operator panel machine data to assign the appropriate protection levels for individual functions and data areas For a number of data types, it is possible to input different protection levels for read and write access authority.
The machine data which can be “locked” by means of protection levels in ShopMill are listed below:

Operator panel machine data	Access to
9182 USER_CLASS_INCH_METRIC	Inch/metric switchover
9200 USER_CLASS_READ_TOA	Read tool offsets
9201 USER_CLASS_WRITE_TOA_GEO	Write tool geometry (including type and cutting edge)
9202 USER_CLASS_WRITE_TOA_WEAR	Write tool wear (without limit value)
9203 USER_CLASS_WRITE_FINE	Write tool wear fine and fine offsets
9210 USER_CLASS_WRITE_ZOA	Write coarse offsets
9215 USER_CLASS_WRITE_SEA	Write setting data
9216 USER_CLASS_READ_PROGRAMM (protection level must be ≤ 6)	Read program
9217 USER_CLASS_WRITE_PROGRAM (protection level must be ≤ 5)	Write/edit program
9218 USER_CLASS_SELECT_PROGRAM (protection level must be ≤ 7)	Enable program selection
9222 USER_CLASS_WRITE_RPA	Write R parameters
9252 USER_CLASS_TM_SKTOOLLOAD	Enable loading of a tool
9253 USER_CLASS_TM_SKTOOLUNLOAD	Enable unloading of a tool
9258 USER_CLASS_TM_SKNCNEWTOOL	Enable setting up of a new tool
9259 USER_CLASS_TM_SKNCDELTOOL	Enable deleting of a tool
9272 USER_CLASS_APPLICATION1 (only for PCU 20; protection level should be 1)	Enable machine operating area
9272 USER_CLASS_APPLICATION1 (only for PCU 20; protection level should be 1)	Enable machine operating area
9272 USER_CLASS_APPLICATION3 (only for PCU 20; protection level should be 1)	Enable program operating area
9510 USER_CLASS_DIRECTORY1_P	Enable network drive 1
9511 USER_CLASS_DIRECTORY2_P	Enable network drive 2

9512 USER_CLASS_DIRECTORY3_P	Enable network drive 3
9513 USER_CLASS_DIRECTORY4_P	Enable network drive 4

Default setting

These machine data are assigned protection level 7 by default during the standard start-up procedure. All these data areas and functions can thus be accessed and altered in keyswitch position 0.
The protection level defaults may need to be changed by the machine manufacturer or end user. Protection levels 0 to 3 can also be entered.

11.2 ISO dialects

You can also create and run ISO dialect programs under ShopMill. For more information on how to set up ISO dialects please refer to the following documentation:

References: /FBFA/, Description of Functions ISO Dialects

The “ISO dialects” function is a software option with order no. 6FC5 253-0AE00-0AA0.

11.3 Spindle control

The ShopMill spindle control has the following special features:

End of program

ShopMill distinguishes between M2/M30 (end of a ShopMill program) and the M function set in MD 10714 $MN_M_NO_FCT_EOP (end of a program created in “Manual” or “MDI” mode).
Setting MD 35040 $MA_SPIND_ACTIVE_AFTER_RESET=2 causes the NCK to switch off the spindle in response to M2/M30, but not in response to the M function programmed in MD 10714 $MN_M_NO_FCT_EOP.
The ShopMill PLC also stops in response to M30 or RESET, but not in response to the set M function.
One of the purposes of this functionality is to allow continuous starting of the spindle in manual mode (e.g. for scratching).

ShopMill uses the following M functions for end of program:

- M function from MD 10714 $MN_M_NO_FCT_EOP: End of main program, spindle continues
- M2, M30: End of main program and return jump to beginning of program, spindle stops
- M17: End of subprogram and return jump to main program, spindle continues operating

Keys

The keys “Spindle right”, “Spindle left” and “Spindle stop” triggers the ShopMill-PLC input signals DB82 DBX9.1 “spindle_start”, DB82 DBX9.4 “spindle_right”, DB82 DBX9.3 “spindle_left” and DB82 DBX9.2 “spindle_stop”.
The ShopMill PLC program writes to the following interface signals in the data block of the spindle:
DB3x.DBX30.0 spindle stop
DB3x.DBX30.1 spindle start CW
DB3x.DBX30.2 spindle start CCW
The spindle can be started and stopped if the channel is in the reset state (DB21.DBX35.7=1) or the channel state is “interrupted” (DB21.DBX35.6=1) and the program state is “interrupted” (DB21.DBX35.3=1).

Note

If the spindle must be stopped when the program is running, then the “Feed Stop/Spindle Stop” interface signal must be set in the user PLC (DB3x.DBX4.3).

The spindle control can be deactivated via the DB82.DBX9.0 interface signal.

11.4 Analog spindles

ShopMill supports analog spindles with encoder for tapping.
The axis index of the analog spindle must be entered in MD 9426 $MM_MA_AX_DRIVELOAD_FROM_PLC1 or
MD 9427 $MM_MA_AX_DRIVELOAD_FROM_PLC2. The system detects the spindle as an analog spindle if one of these display machine data values matches MD 9705 $MM_CMM_INDEX_SPINDLE.

11.5 Automatically generated programs

ShopMill creates several programs automatically during operation.

Directory of part programs:

CMM_SINGLE The program is created when a function is executed in “Manual” mode. The ShopMill PLC switches internally to the “Automatic” operating mode, processes the CMM_SINGLE program and returns to the “Jog” operating mode.

CMM_MDI The G code records programmed under “MDI” are saved in this program.

INPUT_DATA_MM
INPUT_DATA_IN The last parameter values entered in a screen are saved in these programs, depending on the unit of measurement. (INPUT_DATA_MM = values with the unit “mm”; INPUT_DATA_IN = values with the unit “Inch”)

Directory start-up:

REM_DATA.TRC Data which need to remain stored when the machine is next switched off (e.g. the last selected program) are saved in this program.

11.6 Version display

The version of ShopMill PLC is shown in the ShopMill boot display.
The ShopMill and NCU version are shown on the CNC ISO user interface.

- Switch to the CNC ISO operator interface.
- Select menu options “Diagnostics” → “Service Displays” → “Version” → “NCU Version”.
  The NCU version is displayed at the top of the NCU version screen:
  xx.yy.zz 810D or 840D
- Select menu option “MMC Version”.
  You can view the ShopMill version in the displayed list.
  PCU 50: ShopMill..... V xx.yy.zz/nn
  PCU 20: cmm.dll..... V xx.yy.zz/nn

11.7 Action log

You can log sequences of operations in ShopMill in the action log to obtain a history of events for later examination.

For further information about the action log, please see:
References: /IAM/, Installation and Start-Up Guide HMI, IM2 Installation and HMI Embedded

Please refer to the DOCUMENTATION\WINDOWLISTS directory on the ShopMill CD ROM for the assignment between ID numbers listed in the log and the corresponding ShopMill windows.

Note

If you use a PCU 50 with HMI Advanced and would like to log the ShopMill operating processes, you must configure the settings for the trip recorder directly in MD 9012 $MM_ACTION_LOG_MODE. The log is stored in the F:\MMCOW32\TMP_AC_LOG.BIN file. No support for display or readout of this file is provided.

11.8 Mold making

ShopMill can also process mold making programs in addition to programs for the 2 1/2D machining. The mold making programs are executable not only on special mold making machines but also on conventional milling machines for 2 1/2D machining.
However, the milling machines must be optimized for execution mold making programs to achieve the best possible velocity control.

11.8.1 Start-up

You must perform the following steps to achieve the best possible velocity control:

- Set NC machine data
- Optimizing the drive
- Preconfiguring and, if necessary, adapting the cycle “High Speed Settings”

NC machine data

The NC machine data values that you must set are found in the CMM.8x0 file in the section “additional settings for mold and die”. In other words, these machine data values are automatically set upon NC start-up.

Note

Please note that the settings of some machine data values depend on the CNC control or are axis-specific; i.e. you must set these machine data values yourself.

Drive optimization

To adapt the drive for processing of mold making programs, you must optimize all controllers (current controller, speed controller, position controller), the jerk values and the feedforward control using machine-specific machine data, then check these settings based on a circular mold test and contour precision (corners, radii).

You should perform optimization of the controller, jerk values, and feedforward control with the compressor function active to permit the compressor function to be activated without additional re-optimization.
The machine data settings described in file CMM.8x0 already take the compressor function into account.
The compressor function is integrated into the option “Spline interpolation for 3-axis machining” (Order No. 6FC5251-0AF14-0AA0) or “Spline interpolation for 5-axis machining” (Order No. 6FC5251-0AA14-0AA0).

The most important machine-specific machine data items are listed below. This list is not necessarily complete.

Table 11-3 Machine-specific machine data

Channel-specific MD/SD
20600 $MC_MAX_PATH_JERK
20602 $MC_CURV_EFFECT_ON_PATH_ACCEL
20603 $MC_CURV_EFFECT_ON_PATH_JERK
Axis- and drive-specific MD/SD
32200 $MA_POSCTRL_GAIN[n]
32300 $MA_MAX_AX_ACCEL
32431 $MA_MAX_AX_JERK
32432 $MA_PATH_TRANS_JERK_LIM
32433 $MA_SOFT_ACCEL_FACTOR
32434 $MA_G00_ACCEL_FACTOR
32435 $MA_G00_JERK_FACTOR
32810 $MA_EQUIV_SPEEDCTRL_TIME[n]
1004 $MD_CTRL_CONFIG = 1000
1407 $MD_SPEEDCTRL_GAIN_1[n]
1409 $MD_SPEEDCTRL_INTEGRATOR_TIME_1[n]
1414 $MD_SPEEDCTRL_REF_MODEL_FREQ
1500 $MD_NUM_SPEED_FILTERS[n]
1501 $MD_SPEED_FILTER_TYPE[n]
1503 $MD_SPEED_FILTER_2_TIME[n]

"High Speed Settings" cycle

The optimal velocity control for machining is configured within the mold making program with the "High Speed Settings" cycle (CYCLE 832). The cycle is supplied with ShopMill.

You must preconfigure the cycle; in other words, you must set the parameters in advance depending on the machining type (roughing, rough finishing, finishing).

In addition, you can also undertake machine-specific adaptation of the "High Speed Settings" cycle in order to further optimize the processing of the mold making program. The "CYC_832T" cycle is available for this.

Note

The "High Speed Settings" cycle serves only to set the NC functions for the velocity control. In other words, the optimization of the drives described above is a prerequisite for this.

You can call the “high-speed settings” cycle via the cycle support in the ShopMill G code editor.
You will find more precise information on the “high-speed settings” and “CYC_832T” cycles in:

References: /PGZ/, Programming Guide Cycles
SINUMERIK 840D/840Di/810D

11.8.2 Data storage, data transfer

Data storage

To make the optimization of the velocity control with the “High Speed Settings” cycle effective, mold making programs must be divided into a technology program and a geometry program. The technology program contains basic settings, such as zero offset, tool, feed, spindle speed, etc.; the geometry program only contains geometric values of the free-form surface to be machined.
Depending on the application, geometry programs may be anywhere between 500 KB and 100 MB in size. Programs of this size can no longer be processed directly in the NC RAM. This means that the geometry programs must be saved either on the hard drive of the PCU 50 or on a Compact Flash card in the PCU 20.
The compact flash card is not part of the PCU 20, but has to be ordered separately (32 MB: order number 6FC5313-1AG00-0AA0, 64 MB: order number 6FC5313-2AG00-0AA0). The Compact Flash card can be integrated into the program manager as a network drive.

Note

Due to the slower access speeds of the Compact Flash Card, a PCU 50 is recommended for geometry programs larger than 2 MB.

Data transfer

To copy a mold making program from a network drive to the control, an Ethernet connection must be used. The data transfer rate of the serial interface (RS232, V.24) is too low for the transfer of very large part programs.

To execute a mold making program from a network drive, a point-to-point link between the control and the network drive is advisable because only then is continuous data transmission certain.
Execution via the V.24 (RS 232) interface of the PCU 20 is not recommended because of the low transmission rate.

■

Abbreviations

A

ASUB	Asynchronous Subroutine
BP	Basic program
BUFF	Buffer
CCU	Compact Control Unit
CNC	Computerized Numerical Control
COM	Communication Component of NC control that performs and coordinates communication.
DB	Data Block
DBB	Data Block Byte
DBD	Data Block Double Word
DBW	Data Block Word
DBX	Data Block Bit
DRAM	Dynamic memory (volatile)
FB	Function Block
FC	Function Call, Function block in the PLC
GUD	Global User Data
HPU	Handheld Programming Unit
HSK	Horizontal Softkey
IBN	Start-up
INC	Increment
IS	Interface signal

ISA	Industry Standard Architecture
MCP	Machine Control Panel
MD	Machine Data
MDI	Manual Data Automatic
Mode group	Mode group
MPF	Main Program File: Part program (main program)
MPI	Multi-Port Interface
NC	Numerical Control The NC control comprises the components NCK, PLC, PCU and COM.
NCK	Numerical Control Kernel Component of NC control that executes programs and basically coordinates movements for the machine tool.
NCU	Numerical Control Unit: NC module
OB	Organization block in the PLC
OP	Operator Panel
PC	Personal Computer
PCMCIA	Personal Computer Memory Card International Association
PCU	Personal Computer Unit Component of NC control allowing communication between operator and machine.
PG	Programming device
PLC	Programmable Logic Control Component of NC control for processing machine tool control logic
RAM	Random Access Memory, i.e. program memory that can be read and written to
RS-232-C	Serial interface (definition of the exchange lines between DTE and DCE)
SD	Setting Data
SK	SoftKey
SPF	Sub Program File: Subprogram

SRAM	Static RAM (non-volatile)
STL	Statement List
SW	SoftWare
TM	Tool management
T No.	Tool number
TOA	Tool Offset Active Identifier for tool offsets
VSK	Vertical Softkey
WZ	Tool

■

Notes

References

B

Documentation

You will find a list that is updated monthly of the documentation available in each language in the Internet at:

http://www.siemens.com/motioncontrol

Follow the menu items —> “Support” —> “Technical documentation” —> “Overview of publications” or “DOCon WEB”.

Notes

Index

C

M

N

O

P

R

S

T

U

V

W

Notes

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Suggestions

Corrections

For Publication/Manual:

SINUMERIK 840D/840Di/810D

ShopMill

Manufacturer/Service Documentation

Description of Functions

Order No.: 6FC5297-6AD80-0BP3
Edition: 02/05

From

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Company/Dept.

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Suggestions and/or corrections

Overview of SINUMERIK 840D/840Di/810D Documentation (02/2005)

General Documentation

SINUMERIK 840D/810D
Brochure

SINUMERIK 840D/840Di/ 810D/
Catalog Ordering Info. NC 60 *)

Safety Integrated Application Manual
Safety Integrated Application Manual

User Documentation

SINUMERIK 840D/810D/ FM-NC
AutoTurn
– Short Guide
– Programming/ Setup

SINUMERIK 840D/840Di/ 810D
Operator's Guide **– HT 6**

SINUMERIK 840D/840Di/ 810D
Diagnostics Guide *)

SINUMERIK 840D/840Di/ 810D
Operator's Guide *)
– Short Guide
– HMI Embedded
– HMI Advanced

User Documentation

SINUMERIK 840D/840Di/ 810D
Programming Guide
– Short Guide
– Fundamentals *)
– Advanced *)
– Cycles
– Measuring Cycles
– ISO Turning/Milling
– Lists **System Variables**

SINUMERIK 840D/810D
Operator's Guide
– **ManualTurn**
– Short Guide ManualTurn
– **ShopMill**
– Short Guide ShopMill
– **ShopTurn**
– Short Guide ShopTurn

SINUMERIK 840Di
System Overview

Manufacturer/Service Documentation

SINUMERIK
Configuring (HW) *)
– 810D
– 840D

SINUMERIK 840D/840Di/ 810D
Operator Components (HW) *)

SINUMERIK 840D/840Di/ 810D
Description of Functions
– ManualTurn
– ShopMill
– ShopTurn

Manufacturer/Service Documentation

SINUMERIK SIMODRIVE 611D 840D/810D
Description of Functions **Synchronized Actions**

SINUMERIK 840D/840Di/ 810D
Description of Functions **Drive Functions *)**

SINUMERIK 840D/840Di/ 810D
Description of Functions
– Basic Machine *)
– Extended Functions
– Special Functions

SINUMERIK 840D/810D
Description of Functions **Tool Management**

SINUMERIK 840D/810D
Configuring Kit HMI Embedded

SINUMERIK 840D/810D
Description of Functions Operator Interface **OP 030**

SINUMERIK 840D/810D
MCIS
– Computer Link
– Tool Data Inform. Syst.
– NC Data Management
– NC Data Transfer
– Tool Data Communication

Manufacturer/Service Documentation

SINUMERIK SIMODRIVE
Description of Functions SINUMERIK **Safety Integrated**

SINUMERIK 840D
Description of Functions **Digitizing**

SINUMERIK SIMODRIVE
Installation & Start-Up Guide *)
– 810D
– 840D/611D
– HMI

SINUMERIK SIMODRIVE 840D/840Di 810D 611D
– Lists *)

SINUMERIK SIMODRIVE 840D 611D
Description of Functions **Linear Motor**

SINUMERIK SIMODRIVE 840D 611D
Description of Functions
– Hydraulics Module
– Analog Module

MOTION CONTROL SYSTEMS
EMC Guidelines

Electronic Documentation

SINUMERIK SIMODRIVE 840D/840Di/ 810D 611, Motors
DOC ON CD *)
The SINUMERIK System

Manufacturer/Service Documentation

SINUMERIK 840D/840Di/ 810D
Description of Functions **ISO Dialects** for SINUMERIK

SINUMERIK 840Di
Manual (HW + Installation and Start-Up)

SINUMERIK 840D/810D
Description of Functions **Remote Diagnosis**

SINUMERIK 840D/840Di/ 810D
Manual @ Event

*) These documents are a minimum requirement

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Order No.: 6FC5297-6AD80-0BP3

Printed in Germany