SIEMENS

SINUMERIK 840D sl

CNC: ShopMill

Commissioning Manual

Valid for

Control
SINUMERIK 840D sl/840DE sl

Software	*Version*
NCU system software for SINUMERIK 840D sl/840DE sl	1.5
with ShopMill	7.5

01/2008 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” columns.

Status code in the ”Remarks” column:

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

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03/1999	6FC5 297–5AD80–0BP0	**C**
08/2000	6FC5 297–5AD80–0BP1	**C**
12/2001	6FC5 297–6AD80–0BP0	**C**
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11/2003	6FC5 297–6AD80–0BP2	**C**
02/2005	6FC5 297–6AD80–0BP3	**C**
08/2005	6FC5 397–4AP10–0BA0	**C**
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01/2008	6FC5 397–4AP10–2BA0	**C**

Disclaimer of liability
We have checked that the contents of this document correspond to the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. The information given in this publication is reviewed at regular intervals and any corrections that might be necessary are made in the subsequent editions.

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.

Further information is available in the Internet under:
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 data in this document is regularly checked and the necessary corrections are included in subsequent editions. Suggestions for improvement are also welcome.

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Preface

SINUMERIK documentation

The SINUMERIK documentation is organized in three parts:

- General documentation
- User documentation
- Manufacturer/Service documentation

A documentation overview with the available languages, updated monthly, can be found on the Internet under:
http://www.siemens.com/motioncontrol
Follow the menu items —> ”Support” —> ”Technical Documentation” —> ”Documentation Overview” .

The Internet edition of the DOConCD, the DOCon Web, can be found under:
http://www.automation.siemens.com/doconweb

You can find information about training courses on offer and about the FAQs (frequently asked questions) on the Internet under:
http://www.siemens.com/motioncontrol under ”Support”.

Target group

The present documentation is directed at the manufacturer of vertical processing centers or universal milling machines with SINUMERIK 840D sl, and provides the information required for the configuration and commissioning of ShopMill.

Standard scope

This document provides information about the control system design and the interfaces of the individual components. In addition, the commissioning procedure of ShopMill with SINUMERIK 840D sl is described.

For detailed information about individual functions, function assignment and performance data of individual components, please refer to the appropriate 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 manufacturer are also available for the standard SINUMERIK 840D sl. We may refer to them in this documentation if appropriate.

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

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

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

Technical Support

If you have any technical questions, please contact our hotline:

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Note

Country–specific telephone numbers for technical support are provided on the Internet at:
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Questions about this documentation

For questions on the documentation (suggestions, corrections), please send a fax or e–mail to the following address:

Fax: +49 (0) 9131– 98 63315
E–mail: mailto:docu.motioncontrol@siemens.com

You can find a fax template in the appendix to this document.

SINUMERIK Internet address

http://www.siemens.com/sinumerik

Search guides

The alarms of SINUMERIK 840D sl can be found in

References: /DAsl/ Diagnostics Manual

For further useful information on commissioning 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 the document where further information is provided.

Safety information

This manual contains information which you must observe in order to ensure your own personal safety, as well as to avoid material damage. Notes relating to your safety are highlighted in the manual by means of a warning triangle; no warning triangle appears in conjunction with notes relating to material damage. Depending on the hazard level, warnings are indicated in a descending order as follows:

Danger

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

Warning

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

Caution

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

Caution

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

Notice

indicates that an undesirable outcome or state **may** arise if the relevant notes are not observed.

If multiple levels of hazards can occur, the warning is always displayed with the highest possible level. If a warning notice with a safety alert symbol is to indicate physical injury, the same warning may also contain information about damage to property.

Qualified personnel

Setup and operation of the device/equipment/system in question must only be performed using this documentation. Only **qualified personnel** should be allowed to commission and operate the device/system. For the purpose of the safety information in this documentation, a “qualified person” is someone who is authorized to energize, ground, and tag equipment, systems, and circuits in accordance with established safety procedures.

Intended use

Please note the following:

Warning

This equipment is only allowed to be used for the applications described in the catalog and in the technical description, and only in conjunction with non–Siemens equipment and components recommended by Siemens. Correct, reliable operation of the product required proper transport, storage, positioning and assembly, as well as careful operation and maintenance.

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

Contents

Space for your notes

Hardware

1

System configuration

The hardware configuration for ShopMill corresponds to the standard for SINUMERIK 840D sl.

References: /IDsl/, Commissioning CNC: NCK, PLC, drive, SINUMERIK 840D sl;
/GDsl/, Device Manual NCU, SINUMERIK 840D sl

Table 1-1 Basic components

Basic components	Order No.	Comment
TCU	6FC5312–0DA00–0AA0	
NCU 710.1	6FC5371–0AA10–0AA0	CNC: 3 MB; PLC: 128 KB
NCU 710.2	6FC5371–0AA10–0AA1	CNC: 3 MB; PLC: 512 KB
NCU 720.1	6FC5372–0AA00–0AA0	CNC: 3 MB; PLC: 128 KB
NCU 720.2	6FC5372–0AA00–0AA1	CNC: 3 MB; PLC: 512 KB
NCU 720.2PN	6FC5372–0AA01–0AA1	CNC: 3 MB; PLC: 512 KB
NCU 730.1	6FC5373–0AA00–0AA0	CNC: 3 MB; PLC: 128 KB
NCU 730.2	6FC5374–0AA01–0AA0	CNC: 3 MB; PLC: 128 KB
NCU 730.2 PN	6FC5373–0AA01–0AA1	CNC: 3 MB; PLC: 512 KB

Table 1-2 Operator components

Operator Components	Order No.	Comment
OP010 operator panel	6FC5203–0AF00–0AA0	
OP010C operator panel	6FC5203–0AF01–0AA0	
OP010S operator panel	6FC5203–0AF04–0AA0	
OP012 operator panel	6FC5203–0AF02–0AA1	
OP012T operator panel	6FC5203–0AF06–1AA0	
OP015 operator panel	6FC5203–0AF03–0AA0	
OP015A operator panel	6FC5203–0AF05–0AB0	
OP015AT operator panel	6FC5203–0AF05–1AB0	
TP015A operator panel	6FC5203–0AF08–0AB0	
TP015AT operator panel	6FC5203–0AF08–1AB0	
PROFIBUS DP direct key module	6FC5247–0AF11–0AA0	
Direct key module mounting kit	6FC5247–0AF30–0AA0	

Table 1-2 Operator components

PCU 50.3 – C	6FC5210–0DF31–2AA0	1.5 GHz, 512 MB, Windows XP
PCU 50.3 – P	6FC5210–0DF33–2AA0	2.0 GHz, 1024 MB, Windows XP

Table 1-2 Operator components

Operator Components	Order No.	Comment
MCP 310	6FC5203–0AF23–1AA0	
MCP 310 IE	6FC5303–0AF23–1AA0	
MCP 483	6FC5203–0AF22–1AA2	
MCP 483C IE	6FC5303–0AF22–0AA0	
MCP 483 IE	6FC5303–0AF22–1AA0	
CNC full keyboard KB 310C	6FC5203–0AF21–0AA0	
CNC full keyboard KB 483C	6FC5203–0AF20–0AA1	
PC keyboard, standard	6FC5203–0AC01–3AA0	

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Supplementary Conditions

2

Please observe the following supplementary conditions when using ShopMill:

- ShopMill is only executed in channel 1, mode group 1.
- 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 allows for a geometry axis interchange under the following pre-conditions.
  Three geometry axes must always be present.
  The names of the channel axes (MD 20080) and the geometry axes (MD 20060) must be uniquely different.
  A geometry axis interchange can only be programmed for linear axes.
  A geometry axis interchange does not exist for spindles.
  Only ShopMill–approved add–on axes may be exchanged with geometry axes.
- ShopMill operates only with tool management.
  Spindle 1 must always be the change point (see configuration file). The loading 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): Operating area – Machine
  Task 1 (horizontal softkey 2): Operating area – Program manager
  Task 2 (horizontal softkey 3): Operating area – Program
  Task 4 (horizontal softkey 5): Operating area – Tools/Zero offsets
- Several operator panels can be used for ShopMill via TCU.
- The HMI and Windows screen savers must not be used together.
  References: /IHA/, Commissioning Base Software and HMI Advanced, SINUMERIK 840D sl/840Di/840D;
  /IHE/ Commissioning Base Software and HMI Embedded sl, SINUMERIK 840D sl

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Space for your notes

Reserved Functions

3

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

PROG_EVENT

The system cycle PROG_EVENT.SPF is used by the standard cycles and by ShopMill.
If you also want to use the cycle PROG_EVENT.SPF for user functions, you must implement those user functions in the cycles CYCPE_US.SPF or CYCPE1US.SPF. Save these cycles in the directory for user cycles or manufacturer cycles.

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Space for your notes

Commissioning

4

4.1 Prerequisites

Data transfer

For data transfer you require:

- Hardware
  - Programming device with Windows XP or PC with Ethernet
  - Memory stick, if required (Order No.: 6ES7 648–0DC20–0AA0)
- Software
  - SIMATIC Step7, version 5.3 SP2 or higher (for Order No., see SIMATIC catalog)

ShopMill software

- ShopMill on NCU (HMI Embedded sl)

With the ShopMill variant on NCU (HMI Embedded sl), the software is already pre–installed on the CompactFlash Card:

- Drive software (Sinamics)
- PLC software
- NCK software
- ShopMill
- Cycles

The software is provided in 6 languages (German, English, French, Italian, Spanish, and Chinese).

- ShopMill for PCU 50.3

The required software can be found on the DVD "NCU–SysSW and ShopMill–HMI". The software is provided in 6 languages (German, English, French, Italian, Spanish, and Chinese).
The procedure for installing the software on PCU and NC/PLC is described in the following Commissioning sections.

Note

The exact contents of the DVD are located in the file SIEMENSD.RTF (German) or SIEMENSE.RTF (English).
A compatibility list is located in the file 840D_sl_compatibility_list.xls.

4.2 First commissioning

4.2.1 Sequence

Before you begin commissioning, please read the general conditions and reserved functions.

For installation and commissioning, proceed as follows:

1. ShopMill installation on PCU (for ShopMill on PCU 50.3 only).
   For ShopMill on NCU (HMI Embedded sl), the ShopMill software is pre−installed.
2. PLC commissioning
3. NCK commissioning
4. Install additional functions (optional)
5. Adapt display machine data
6. Customize the operator interface (optional)
7. Run a test using the acceptance certificate

You can commission tool management either together with NCK and PLC commissioning or afterwards. If tool management is already set up on the machine you only need to adapt the display machine data for tool management; (see Section 8.2 ”Commissioning sequence”).

You can find a detailed description of the commissioning process in the following documentation:

References: /IDsl/, Commissioning Manual CNC: NCK, PLC, drive, SINUMERIK 840D sl;
/IHE/, Commissioning Base Software and HMI Embedded sl, SINUMERIK 840D sl;
/IHA/, Commissioning Base Software and HMI Advanced, SINUMERIK 840D sl/840D/840Di sl

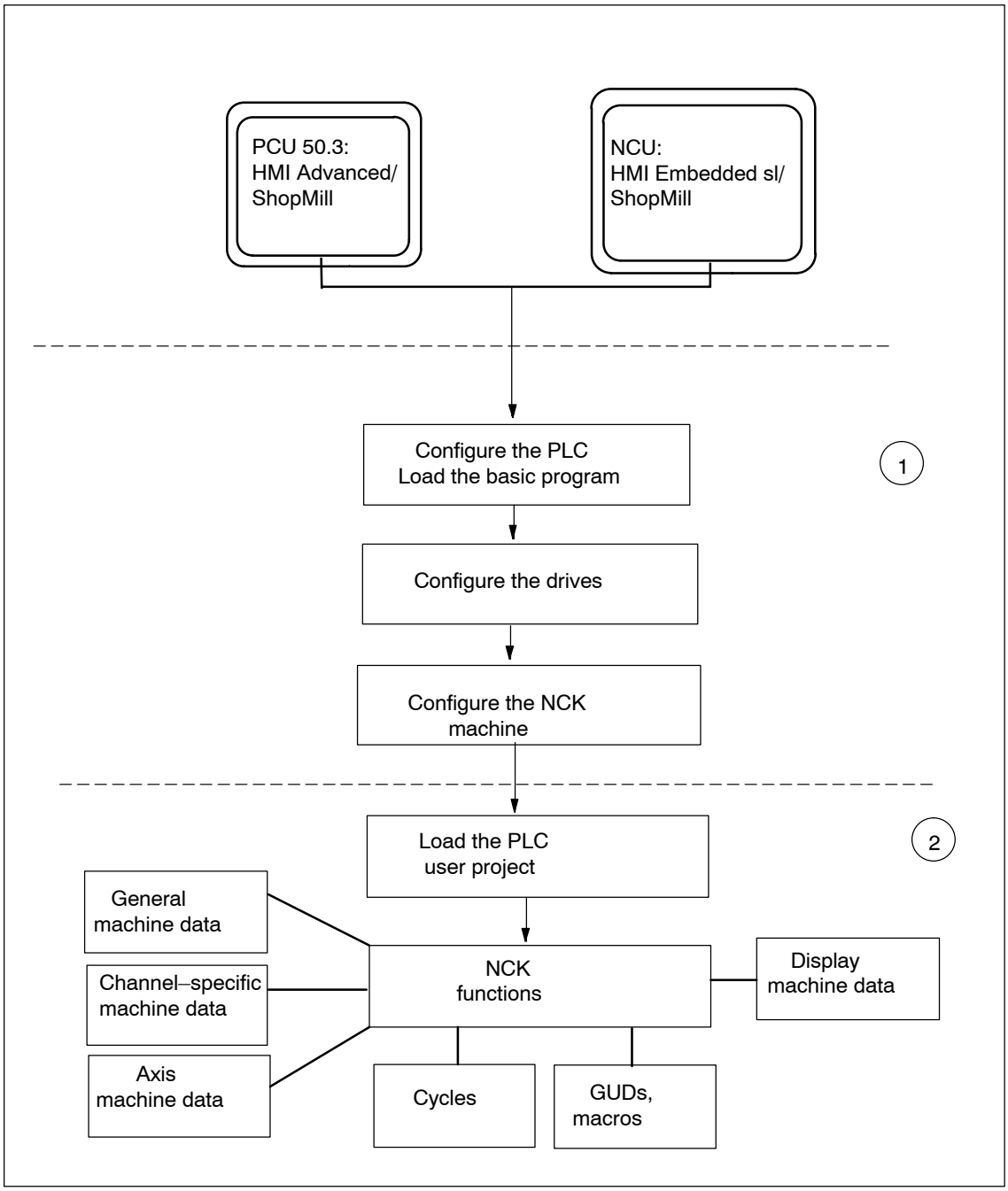

Fig. 4-1 General sequence of first commissioning

General sequence of first commissioning

(1) The first step in the commissioning sequence is to configure the control system, i.e. to set up communication between all involved components. PLC, drive and NCK are commissioned
References: /IDsl/, Commissioning Manual CNC: NCK, PLC, drive, SINUMERIK 840D sl

(2) In a second step, the individual functions are commissioned in several runs. The commissioning sequence for these functions is described in the following sections.

4.2.2 Installation of ShopMill on NCU (HMI Embedded sl)

For the purposes of operating ShopMill on NCU (HMI Embedded sl) the whole software is pre–installed on the CompactFlash Card. Only adaptations of the NCK and PLC remain to be carried out.

Note

ShopMill uses the alarm texts and PLC messages of the CNC ISO operator interface. You can find detailed information on this subject as well as the the software installation in the following document:

References: /IHE/, Commissioning Base Software and HMI Embedded sl, SINUMERIK 840D sl

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4.2.3 Installing ShopMill on PCU 50.3

If you wish to install ShopMill on the PCU 50.3, the HMI Advanced software must already be installed on the PCU 50.3.
After installation, the internal HMI Embedded on the NCU must be deactivated. It is deactivated or activated by means of the service program Win SCP.
Start WinSCP and select ”Open Terminal” under Commands.
The ”sc disable hmi” action deactivates the internal HMI Embedded.
The ”sc enable hmi” action activates the internal HMI Embedded.

References: /IDsl/, Commissioning Manual CNC: NCK, PLC, drive, SINUMERIK 840D sl;
/IHA/, Commissioning Base Software and HMI Advanced, SINUMERIK 840D sl/840D/840Di

You can install ShopMill on the PCU 50.3 in one of three different ways:

- Installation via a network link
- Installation from data media (e.g. DVD)
- Installation Via USB interface

Note

ShopMill uses the alarm texts and PLC messages of the CNC ISO operator interface. You can find detailed information on this subject as well as the the software installation in the following document:

References: /IHA/, Commissioning Base Software and HMI Advanced, SINUMERIK 840D sl/840D/840Di

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4.2.4 PLC commissioning

To commission the PLC you must first create and then load a PLC user project.

To commission the PLC, proceed as follows:

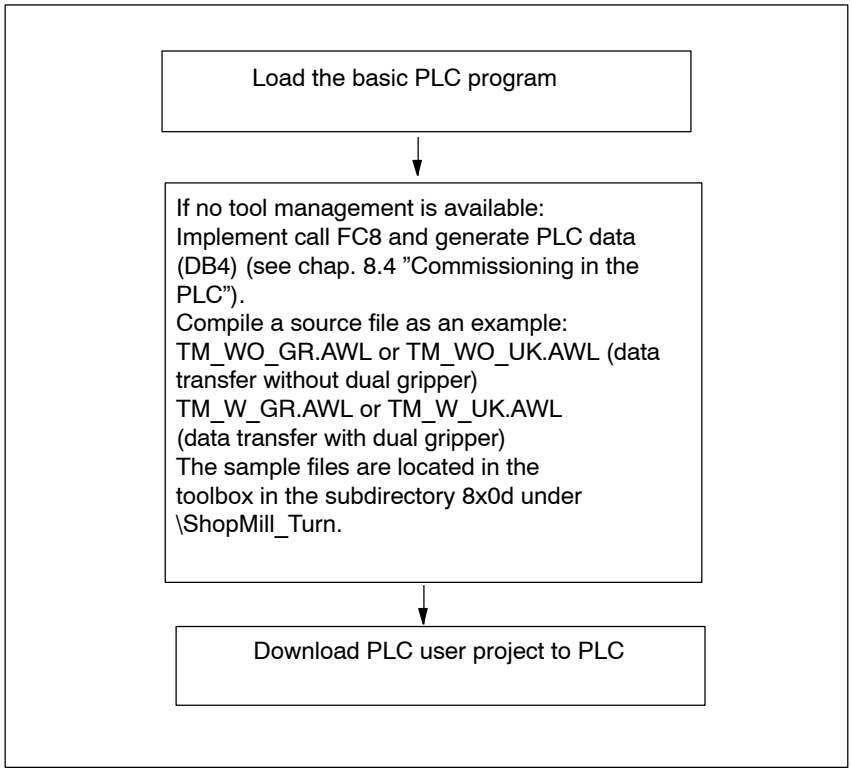

Fig. 4-2 PLC commissioning

4.2.5 NCK commissioning

The commissioning of the NCK features the following items:

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

You only need to set up the axes and spindles if you have not yet done so on the machine. When setting up the axes and spindles please observe the general conditions; (see Section 2 ”General conditions”).

Similarly, you only need to set up tool management in the NCK if this does not yet exist.

Note:
Sample files are located in the directory under CYCLES\SC\PROG\TEMPLATES_DEU or CYCLES\SC\PROG\TEMPLATES_ENG.

SINUMERIK 840D sl

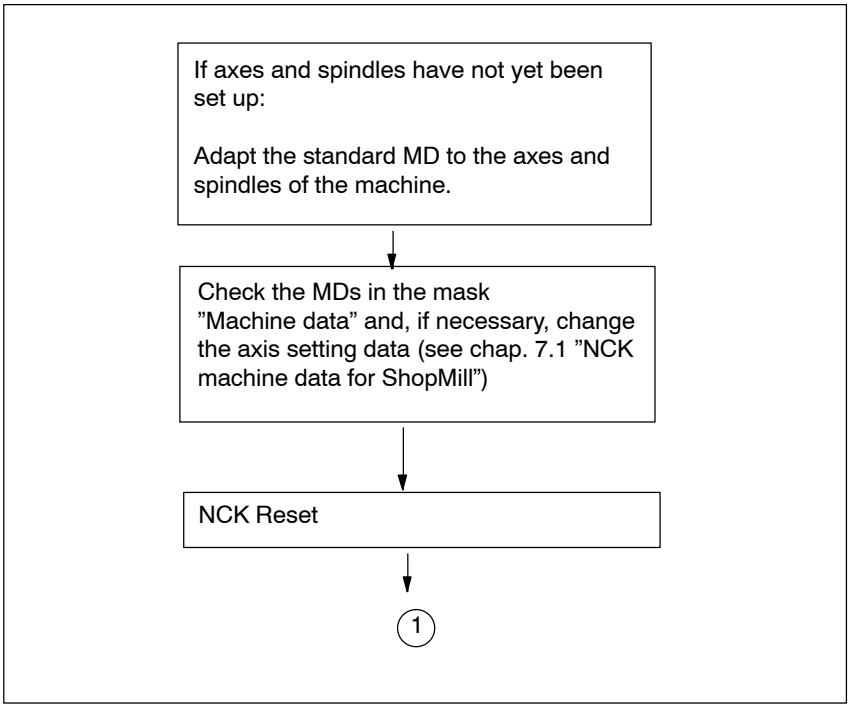

Fig. 4-3 NCK SINUMERIK 840D sl commissioning

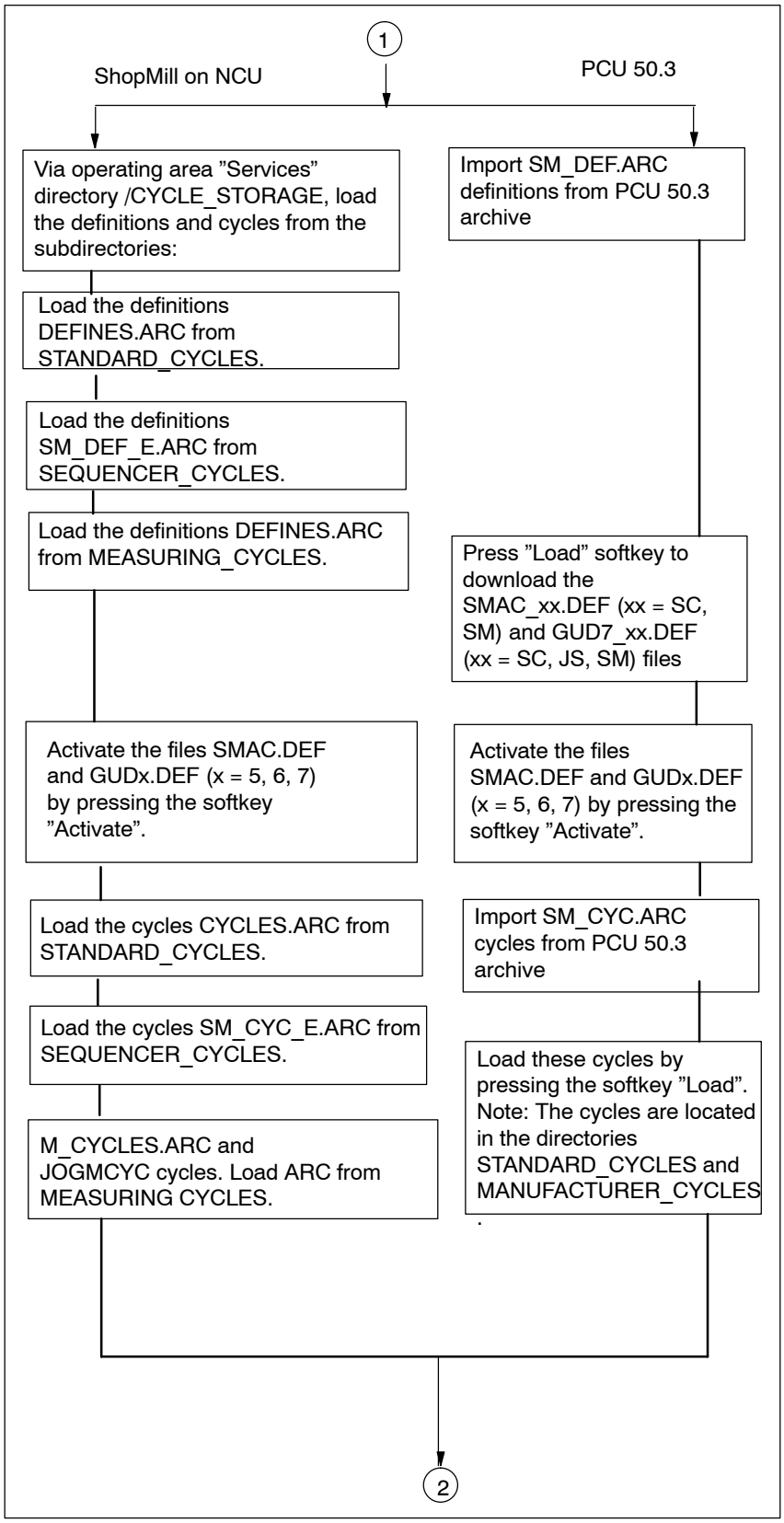

Fig. 4-4 NCK SINUMERIK 840D sl commissioning

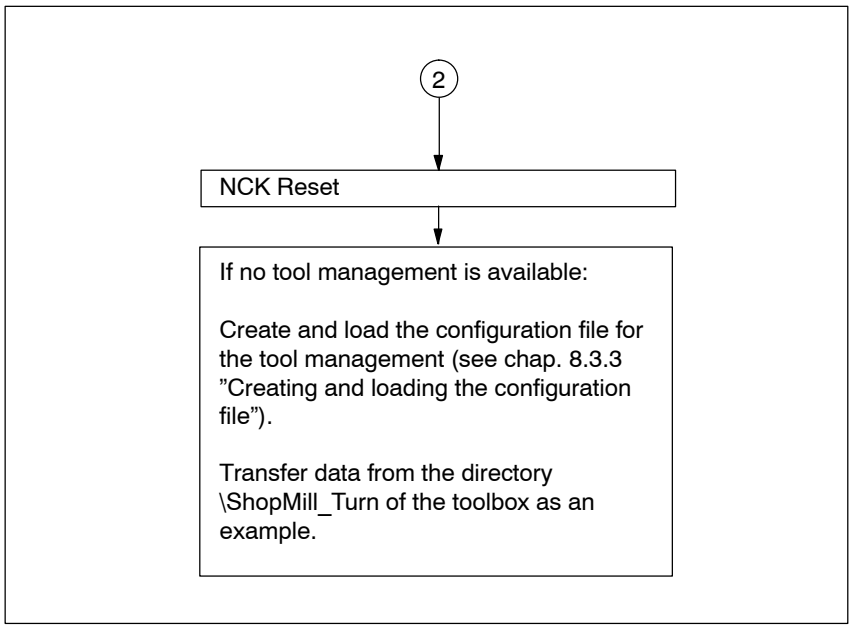

Fig. 4-5 NCK SINUMERIK 840D sl commissioning

4.2.6 Display machine data

After the installation of ShopMill on the PCU and the commissioning of NCK and PLC are completed, you still have to adapt the display machine data.
The display machine data are listed in Section 7.2 ”Display Machine Data for ShopMill”.

4.2.7 Acceptance report

The acceptance certificate can be used to test the installed ShopMill functions once ShopMill commissioning has been completed.
The acceptance certificate is included on the ShopMill DVD.

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PLC Program

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5.1 Structure of the PLC program

The tool management and the basic PLC program (FB1, FC2, ...) must be called in the OBs 1, 40 and 100.

For a description of the function blocks and the basic PLC program, please refer to:

References: /FB1/, Description of basic machine functions, P3 sl, ”Basic PLC program”

5.2 Example source files

ShopMill supplies various source files for sample blocks. You can adapt and compile these source files or you can use your own blocks.

Table 5-1 Example source files

Source	Mnemonics	Note	Block	Comment
TM_W_GR.AWL TM_WO_GR.AWL	German	The indicated block numbers are programmed in absolute terms.	FC 100	Sample block for configuring tool management The block is called in OB100.
			FB 110	Sample block for data transfer of tool management. The block is called in OB1.
			DB 110	Instance data block for FB 110
TM_W_UK.AWL TM_WO_UK.AWL	English	same as TM_W_GR.AWL and TM_WO_GR.AWL		

The sample blocks are located in the toolbox under \ShopMill_Turn.

5.3 Standard interface signals for/from ShopMill

The following presents a listing of the standard interface signals that are affected by the ShopMill interface (DB19).

Table 5-2 Standard interface signals for/from ShopMill

Byte	Designation
DB19	**Signals from operator panel (HMI——>PLC)**
DBB21	Selection of operating areas see Section 6.1 ”HMI interface DB19”
DBX18 Bit0	Update tool data see Section 6.1 ”HMI interface DB19”
DBX20 Bit6	Simulation active see Section 6.1 ”HMI interface DB19”
DBW24	Current image numbers of ShopMill see Section 6.1 ”HMI interface DB19”
DB21	**Signals to NCK channel (PLC——>NCK)**
DBX7.5	Deactivate global start lock see Section 6.1 ”HMI interface DB21”

Note

- A feed lock with stationary spindle must not be implemented in the PLC user program since the positioning of the axes to the next position with stationary spindle is carried out during feed for ”index circle thread tapping with positioning on circle”.

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Signal Description

6

6.1 HMI interface DB19

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: Start simulation		

DB19 **DBB21** Data block	E_AcitivWA **Active MMC operating area** Signal(s) from ShopMill		
Edge evaluation: No		Signal(s) updated: Cyclic	Signal(s) valid from software version: ShopMill 7.1
Significance of signal	OPEN (HMI Advanced) SK number (as predefined in the control (Task+1)) Classic (HMI Embedded) 201: SM machine 202: SM directory 203: SM program 204: SM alarms/messages 205: SM tool		

DB19 **DBW24** 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 7.5	
Significance of signal	The signal outputs the image number of the current ShopMill image. The following image number can be output: **No. ShopMill image** Manual machine mode: 19 Basic image 2 T,S,M... 21 Setting basic NPV* 30 Zero point workpiece 5 Zero point workpiece – Set up edge 7 Zero point workpiece – User mask* 31 Zero point workpiece – Align edge/user mask* 32 Zero point workpiece – Distance 2 edges/user mask* 33 Zero point workpiece – Right–angled edge 8 Zero point workpiece – Random edge/user mask* 34 Zero point workpiece – Rectangular pocket 9 Zero point workpiece – 1 bore/user mask* 35 Zero point workpiece – 2 bores 36 Zero point workpiece – 3 bores 37 Zero point workpiece – 4 bores 38 Zero point workpiece – Rectangular pin 10 Zero point workpiece – 1 circular pin/user mask* 39 Zero point workpiece – 2 circular pins 40 Zero point workpiece – 3 circular pins 41 Zero point workpiece – 4 circular pins 42 Zero point workpiece – Set up plane* 11 Zero point workpiece – Adjusting probe – length* /user mask* 12 Zero point workpiece – Adjusting probe – radius* 50 Measuring tool 16 Measuring tool – Manual length /user mask* 17 Measuring tool – Manual diameter /user mask* 13 Measuring tool – Auto length*/user mask* 14 Measuring tool – Auto diameter*/user mask* 51 Measuring tool – User mask* 15 Measuring tool – Adjusting measuring probe*/user mask* 52 Measuring tool – Adjusting fixed point/user mask* 60 Swivel * 4 Positioning 18 Face milling* 3 Face milling – Transfer with OK 90 /user mask * 91 /Transfer image of user mask* 1 ShopMill Settings MDA mode: 20 MDA Auto machine mode: 200 Basic image 210 Program influence 220 Record search 230 User mask* 241 Simultaneous recording – Settings* 242 Simultaneous recording – Top view* 243 Simultaneous recording – 3–plane view* 244 Simultaneous recording – Volume model* 250 Expanded softkey bar – Setting		

DB19 **DBW24** 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 7.5
Significance of signal	Operating area program manager: 300 Directory NC 310 Part programs* 320 Subroutines* 330 User directory 1* 340 User directory 2* 350 User directory 3* 360 User directory 4* 380 Standard cycles* 381 Manufacturer cycles* 382 User cycles* 383 User directory 5* 384 User directory 6* 385 User directory 7* 386 User directory 8* Operating area program: 400 Machining 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 mask* 520 User mask* 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 mask* 690 Machine data 680 User data Run screen 910 Run screen in operating area manual machine* 920 Run screen in operating area machine MDA* 930 Run screen in operating area auto machine* * = If image is available		

6.2 HMI interface DB21

In ShopMill, the start of a program can only be executed in the machine area by default. Starting a program in any of the other areas (e.g. tools) is prevented by a global start lock.

Note

You can specify, via MD 9719, bit 9, that it should be possible to start a program from all masks.

In automated sequences, e.g. a start from the PLC as used on a machine with a pallet change system, this global start lock can be deactivated by means of interface signal DB21.DBX7.5.
This prevents a program start of this nature being locked by the operator interface.

DB21 **DBX7.5** Data block	suppressStartLock **Deactivate global start lock** PLC —> NCK		
Edge evaluation: No		Signal(s) updated: Cyclic	Signal(s) valid from software version: ShopMill 7.1
Significance of signal	0: Do not cancel global start lock 1: Deactivate global start lock		

So that an alarm is output in the event of a start being attempted while the global start lock is activated, bit 6 in the machine data 16956 $MN_ENABLE_ALARM_MASK must be set.

6.3 Overview of the former ShopMill interface

The ShopMill PLC program and the corresponding ShopMill interface DB82 are omitted in the new software release of ShopMill. The following tables show where you can find the old interface signals of the DB82.

6.3.1 Signals to ShopMill (input signals)

Table 6-1 Signals to ShopMill (input signals)

Address DB82 DBX	Name Comments	Spares
0.0 – 0.7	CMM_IN.transfer_base_sig Transfer mode for MTTS signal	Omitted since ShopMill PLC no longer exists
2.0	CMM_IN.base_sig.main_mode_mill.manual ShopMill manual mode	Transfer is via FC19/FC24 to the standard interface DB11.DBX0.2 JOG.
2.1	CMM_IN.base_sig.main_mode_mill.automatic ShopMill automatic mode	Transfer is via FC19/FC24 to the standard interface DB11.DBX0.0 AUTO.
4.0	CMM_IN.base_sig.reset RESET for ShopMill	Transfer is via FC19/FC24 to the standard interface DB21.DBX7.7 Reset.
4.1	CMM_IN.base_sig.nc_cycle_start Cycle start	Transfer is via FC19/FC24 to the standard interface DB21.DBX7.1 NC–Start.
4.2	CMM_IN.base_sig.nc_cycle_stop Cycle stop	Transfer is via FC19/FC24 to the standard interface DB21.DBX7.3 NC–Stop.
6.0	CMM_IN.sub_mode_mill.tool Operating area – tool	Omitted. Use the appropriate key on the operator panel; (see section 10.5 OP hotkeys, PLC keys).
6.1	CMM_IN.sub_mode_mill.directory Operating area – Directory	Omitted. Use the appropriate key on the operator panel; (see section 10.5 OP hotkeys, PLC keys).
6.2	CMM_IN.sub_mode_mill.messages Operating area – Alarms/messages	Omitted. Use the appropriate key on the operator panel; (see section 10.5 OP hotkeys, PLC keys).
6.3	CMM_IN.sub_mode_mill.program Operating area – program	Omitted. Use the appropriate key on the operator panel; (see section 10.5 OP hotkeys, PLC keys).
6.4	CMM_IN.sub_mode_mill.oem1 Operating area – OEM1	n.a.
6.5	CMM_IN.sub_mode_mill.oem2 Operating area – OEM2	n.a.
6.6	CMM_IN.sub_mode_mill.customer Operating area – Customer	n.a.
6.7	CMM_IN.sub_mode_mill.mda Operating area – MDA	Transfer is via FC19/FC24 to the standard interface DB11.DBX0.1 MDA.
8.0	CMM_IN.spndle_interface_number Assignment of spindle/axis data	Omitted since ShopMill PLC no longer exists
9.0	CMM_IN.user_defined_spindle_control User–defined spindle control	Omitted since ShopMill PLC no longer exists

Address DB82 DBX	Name Comments	Spares
9.1	CMM_IN.spindle_start Spindle start	Standard interface DB3x.DBX30.1/30.2
9.2	CMM_IN.spindle_stop Spindle stop	Standard interface DB3x.DBX30.0
9.3	CMM_IN.spindle_left Spindle start	Standard interface DB3x.DBX30.2
9.4	CMM_IN.spindle_right Spindle start	Standard interface DB3x.DBX30.1
9.5	CMM_IN.program_extern_selected Program is selected in the PLC.	No longer required due to updated logic in ShopMill interface.
9.6	CMM_IN.disable_cnc_standard Locking switchover to CNC–ISO user interface	ShopMill Open (PCU 50.3): not available; ShopMill on NCU (HMI Embedded): lock for the remaining operating areas by means of protective levels
9.7	CMM_IN.cmm_activ_in_cnc_mode ShopMill PLC active during CNC–ISO operation	Omitted since ShopMill PLC no longer exists
10.0	CMM_IN.program_test_request Select function for program test	MMC –> PLC DB21.DBX25.7 PLC –> NCK DB21.DBX1.7 Connect as in the PLC user program.
10.1	CMM_IN.dry_run_request Select DryRun function	MMC –> PLC DB21.DBX24.6 PLC –> NCK DB21.DBX0.6 Connect as in the PLC user program.
10.2	CMM_IN.m01_request Select function M01	MMC –> PLC DB21.DBX24.5 PLC –> NCK DB21.DBX0.5 Connect as in the PLC user program.
10.3	CMM_IN.skip_block_request Select function for skipping record	MMC –> PLC DB21.DBX26.0 ff PLC –> NCK DB21.DBX2.0 ff Connect as in the PLC user program
10.4	CMM_IN.boot_standard System boot in CNC–ISO user interface	ShopMill Open (PCU 50.3): Change PoweronTask in control, or remove ShopMill operating area from the control, or assign protective levels to the ShopMill operating areas in the control; ShopMill on NCU (HMI Embedded): Assign a protective level to the ShopMill operating area
10.5	CMM_IN.nck_auto_req Prepare record search PLC	Omitted since operating area jog, automatic and MDA are now identical to the NCK modes
10.6	CMM_IN.spindle_act_m30_reset Spindle active after M30 and reset	Omitted since ShopMill PLC no longer exists
10.7	CMM_IN.ignore_nck_alarm Ignore NCK alarm in the event of cycle start	Omitted since the NC start of ShopMill is no longer manipulated
11.1	CMM_IN.get_tool_data Update tools data	Omitted since the NC start of ShopMill is no longer manipulated

Address DB82 DBX	Name Comments	Spares
11.5	CMM_IN.drf_request Select the function DRF	MMC –> PLC DB21.DBX24.3 PLC –> NCK DB21.DBX0.3 Connect as in the PLC user program.
12	CMM_IN.ext_m_cmd_1 1st expanded M function to output tool–specific functions	Omitted since ShopMill PLC no longer exists (see also display MD 9739 to 9746)
13	CMM_IN.ext_m_cmd_2 2nd expanded M function to output tool–specific functions	Omitted since ShopMill PLC no longer exists (see also display MD 9739 to 9746)

6.3.2 Signals from ShopMill (output signals)

Table 6-2 Signals from ShopMill (output signals)

Address DB82 DBX	Name Comments	Spares
30.0	CMM_OUT.base_sig.main_mode_mill.manual ShopMill manual mode	Transfer is via FC19/FC24 to the standard interface DB11.DBX6.2 JOG
30.1	CMM_OUT.base_sig.main_mode_mill.automatic ShopMill automatic mode	Transfer is via FC19/FC24 to the standard interface DB11.DBX6.0 AUTO
32.0	CMM_OUT.base_sig.reset Reset performed	Can be simulated with the interface signal DB21.DBX35.7 channel status reset
32.1	CMM_OUT.base_sig.nc_cycle_activ Cycle active	Transfer is via FC19/FC24 to the standard interface DB21.DBX
32.2	CMM_OUT.base_sig.nc_cycle_activ Cycle interrupted	Transfer is via FC19/FC24 to the standard interface DB21.DBX
34.0	CMM_OUT.sub_mode_mill.tool Operating area – Tool is selected	Standard interface signal DB19.DBB21 = 205
34.1	CMM_OUT.sub_mode_mill.directory Operating area – Directory is selected	Standard interface signal DB19.DBB21 = 202
34.2	CMM_OUT.sub_mode_mill.messages Operating area – Alarms/Messages is selected	Standard interface signal DB19.DBB21 = 204
34.3	CMM_OUT.sub_mode_mill.program Operating area – Program is selected	Standard interface signal DB19.DBB21 = 203
34.7	CMM_OUT.sub_mode_mill.mda Operating area – MDA is selected	Transfer is via FC19/FC24 to the standard interface DB11.DBX6.1 MDA
36.0	CMM_OUT.cmm_plc_activ ShopMill PLC active	Omitted since ShopMill PLC no longer exists
36.1	CMM_OUT.cmm_mmc_activ ShopMill user interface active	ShopMill Open (PCU 50.3): is not being analyzed ShopMill on NCU (HMI Embedded): DB19.DBB21
36.2	CMM_OUT.spindle_start_req Spindle start requested (M3/M4 output to spindle)	Standard interface DB3x.DB64.6 and DB3x.DB64.7

Table 6-2 Signals from ShopMill (output signals)

Address DB82 DBX	Name Comments	Spares
36.3	CMM_OUT.spindle_stop_req Spindle stop requested, M5 output to spindle	Standard interface DB3x.DB64.6 and DB3x.DB64.7
36.4	CMM_OUT.spindle_right Spindle rotation right preselected	Standard interface DB3x.DB64.6 and DB3x.DB64.7
36.5	CMM_OUT.spindle_left Spindle rotation left preselected	Standard interface DB3x.DB64.6 and DB3x.DB64.7
36.7	CMM_OUT.ext_prog_sel External processing program is selected	n.a.
37.0	CMM_OUT.program_selection_done Acknowledgment from HMI that a program has been selected	Omitted because of the new start lock logic of the NCK. The program can be selected and started directly.
37.1	CMM_OUT.program_test_activ Function for program test is active	Standard interface signal DB21.DBX33.7
37.2	CMM_OUT.dry_run_activ Function for DryRun is active	Standard interface signal DB21.DBX318.6
37.3	CMM_OUT.m01_activ Function M01 is active	Standard interface signal DB21. DBX32.5
37.4	CMM_OUT.skip_block_activ Function for skipping record is active	Standard interface signal DB21. DBX26.0ff
37.7	CMM_OUT.start_up_activ ShopMill boot active	n.a.
38.1	CMM_OUT.tool_un_load_internal Load/unload tool without moving magazine	Standard interface signal DB71.DBX32.0 for the 1st loading point
38.2	CMM_OUT.drf_activ Function DRF is active	Standard interface signal DB21.DBX24.3
38.3	CMM_OUT.nc_start_ineffective NC start has no effect	Global start lock can be deactivated. Standard interface signal DB21.DBX7.5
42.0	CMM_OUT.tool_m_function_1_on Tool–specific function 1 active	Omitted since ShopMill PLC no longer exists (see also display MD 9739 to 9746)
42.1	CMM_OUT.tool_m_function_2_on Tool–specific function 2 active	Omitted since ShopMill PLC no longer exists (see also display MD 9739 to 9746)
42.2	CMM_OUT.tool_m_function_3_on Tool–specific function 3 active	Omitted since ShopMill PLC no longer exists (see also display MD 9739 to 9746)
42.3	CMM_OUT.tool_m_function_4_on Tool–specific function 4 active	Omitted since ShopMill PLC no longer exists (see also display MD 9739 to 9746)
42.4	CMM_OUT.tool_m_function_1_activ Tool–specific function 1 valid	Omitted since ShopMill PLC no longer exists (see also display MD 9739 to 9746)
42.5	CMM_OUT.tool_m_function_2_activ Tool–specific function 2 valid	Omitted since ShopMill PLC no longer exists (see also display MD 9739 to 9746)
42.6	CMM_OUT.tool_m_function_3_activ Tool–specific function 3 valid	Omitted since ShopMill PLC no longer exists (see also display MD 9739 to 9746)

Table 6-2 Signals from ShopMill (output signals)

Address DB82 DBX	Name Comments	Spares
42.7	CMM_OUT.tool_m_function_4_activ Tool–specific function 4 valid	Omitted since ShopMill PLC no longer exists (see also display MD 9739 to 9746)
44	CMM_OUT.mask_number Current image number from ShopMill	Standard interface signal DB19.DBW24

■

Space for your notes

Machine Data

7

7.1 NCK machine data for ShopMill

The commissioning of NCK requires that all relevant NCK machine data (including the tool management) are set with the ShopMill–specific values.

In the operating area ”Tools – zero” open the mask ”Machine data” by pressing the softkey ”Machine data” in the extended softkey bar. All required machine data for ShopMill are displayed here with information about setpoints and actual values.
Correctly set machine data is marked with a tick. Machine data marked with an exclamation mark must be corrected accordingly. A red exclamation mark in the header (no., MD, target, actual) already points out to you that machine data must be corrected.

The following signs show the rule for setpoint to actual value:

- =: must be exact
- ≤: must be at least
- &: certain bits must be exact

If no rule is indicated for setpoint to actual value, it is only a suggestion.

NCK machine data with exact values must be set as specified. NCK machine data with minimum values can be adapted to the specific features of your machine.

The activation mode for each item of machine data is indicated in the column after the actual value display.

- po: Power On (softkey ”NCK reset”)
- cf: Configuration (softkey ”Set MD effective”)
- so: Immediately (no action required)
- re: Reset (”Reset” key on machine control panel)

With the softkey ”Actual=setpoint” you adjust incorrect values to the minimum requirements of ShopMill if you confirm the following question with ”OK”.
If the actual value is too low, for example, the value of the machine data is set to the lowest setpoint. For bit masks only the missing bits are set.

Note

The file SIEMENSD.RTF or SIEMENSE.RTF provides a list with the required settings of the ShopMill machine data. You are advised to print these out. You can then check and if necessary correct the specific values more conveniently.

Note

Please note that the machine data record also contains machine data for configuring the memory.

For an exact description of all NC machine data, please refer to:
References: /LIS1sl/, Lists (book 1);
/LIS2sl/, Lists (book 2);
/IDsl/, Commissioning CNC: NCK, PLC, drive, SINUMERIK 840D sl;
/FB/, Description of Functions

NCU load

The load placed on the NCU by the position controller and the interpolator must not exceed a maximum value of 70%. The load can be set via NCK 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 altered.
- Repeat the steps described.

7.2 Display machine data for ShopMill

After the installation of ShopMill on the PCU and the commissioning of NCK and PLC are completed, you still need to adapt the display machine data.
In any case, you must check the settings of the display machine data that are identified in table 7-1 with "*".

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
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	200
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 tool holders	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	Variation of smallest possible cutter radius in percent	5

MD number	MD identifier	Comment	Preset default
9658	$MM_CMM_CYC_MAX_CONT_PO_TO_RAD	Variation of 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
9662*	$MM_CMM_COUNT_GEAR_STEPS	Number of gear stages	1
9663	$MM_CMM_TOOL_DISPLAY_IN_DIAM	Display radius/diameter for tool	1
9664	$MM_CMM_MAX_INP_FEED_P_MIN	Maximum feed in mm/min	10000.0
9665	$MM_CMM_MAX_INP_FEED_P_ROT	Maximum feed in mm/rev	1.0
9666	$MM_CMM_MAX_INP_FEED_P_TOOTH	Maximum 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_POCKE	Radius of approach circle for finishing 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
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
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
9688	$MM_CMM_COUNT_GEAR_STEPS_S2	Number of gear stages for the front spindle	1
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
9708	$MM_CMM_INDEX_SPINDLE_2	Axis index for 2nd spindle	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 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
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	–
9739	$MM_CMM_M_CODE_TOOL_FUNC_1_ON	M code for tool–specific function 1 ON	–1
9740	$MM_CMM_M_CODE_TOOL_FUNC_1_OFF	M code for tool–specific function 1 OFF	–1
9741	$MM_CMM_M_CODE_TOOL_FUNC_2_ON	M code for tool–specific function 2 ON	–1
9742	$MM_CMM_M_CODE_TOOL_FUNC_2_OFF	M code for tool–specific function 2 OFF	–1

MD number	MD identifier	Comment	Preset default
9743	$MM_CMM_M_CODE_TOOL_FUNC_3_ON	M code for tool–specific function 3 ON	–1
9744	$MM_CMM_M_CODE_TOOL_FUNC_3_OFF	M code for tool–specific function 3 OFF	–1
9745	$MM_CMM_M_CODE_TOOL_FUNC_4_ON	M code for tool–specific function 4 ON	–1
9746	$MM_CMM_M_CODE_TOOL_FUNC_4_OFF	M code for tool–specific function 4 OFF	–1
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	Maximum 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	Maximum circumferential speed for tool measurement for rotating Spindle	100
9760	$MM_CMM_SPIND_SPEED_ROT_SP	Maximum 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	Maximum feed for tool measurement for rotating Spindle	20
9772	$MM_CMM_T_PROBE_MEASURING_DIST	Measurement distance 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 for time display	0x7F
9778	$MM_CMM_MEAS_PROBE_SOUTH_POLE	Measuring probe length referenced to lower edge	1
9779	$MM_CMM_MEAS_PROBE_IS_MONO	Workpiece measuring probe is mono probe	0
9855	$MM_ST_CYCLE_TAP_SETTINGS	Settings for thread tapping	0

MD number	MD identifier	Comment	Preset default
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	Min. input limit: 0	Max. input limit: 1	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: LONG		Valid as of software version: ShopMill 6.4	
Significance:	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	Min. input limit: 0	Max. input limit: 2	
Change becomes effective after: POWER ON	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version: ShopMill 6.1	
Significance:	In this MD you stipulate the basic configuration for simulation and free contour programming. 0 = No specific configuration 1 = Turning machine configuration 2 = Milling machine configuration		

9422 MD number	**$MM_MA_PRESET_MODE** **Preset/basic offset in JOG**		
Default setting: 1	Min. input limit: 0	Max. input limit: 3	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 6.4	
Significance:	In this MD you stipulate the behavior of the function ”Set zero offset” in ”Machine – manual” mode. ≠ 2: Zero point is saved in the currently active zero offset, in other cases 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	Min. input limit: 0	Max. input limit: 31	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 6.4	
Significance:	You enter the machine index of an analog spindle for the drive load display in this MD. The thread tapping is carried out with an analog tool spindle with compensation chuck.		

9427 MD number	$MM_MA_AX_DRIVELOAD_FROM_PLC2 **Machine index of an analog spindle**		
Default setting: 0	Min. input limit: 0	Max. input limit: 31	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 6.4	
Significance:	You enter the machine index of an analog spindle for the drive load display in this MD. The thread tapping is carried out with an analog tool spindle with compensation chuck.		

9428 MD number	$MM_MA_SPIND_MAX_POWER **Maximum value of the spindle performance display**		
Default setting: 100	Min. input limit: 100	Max. input limit: ***	
Change becomes effective after: POWER ON	Protection level: 3/4	Units: %	
Data type: WORD		Valid as of software version ShopMill 6.4	
Significance:	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: 200	Min. input limit: 100	Max. input limit: ***	
Change becomes effective after: POWER ON	Protection level: 3/4	Units: %	
Data type: WORD		Valid as of software version ShopMill 6.4	
Significance:	In this MD you stipulate the display range of the bar displaying spindle utilization. Depending upon the value entered, the displayed percentage values and the extension of the color areas change. Value entered = 100: Percentage values 0, 80, and 100% are displayed. The color display changes from green to red starting at 80%. Value entered = > 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	Min. input limit: –	Max. input limit: –	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: mm	
Data type: DOUBLE		Valid as of software version ShopMill 6.3	
Significance:	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	Min. input limit: –	Max. input limit: –	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: mm	
Data type: DOUBLE		Valid as of software version ShopMill 6.3	
Significance:	When entering the fine adjustment the difference between the previous value and the 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	Min. input limit: –	Max. input limit: –	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: Hex	
Data type: LONG		Valid as of software version ShopMill 6.3	
Significance:	Bit 0 to 4: Reserved Bit 5: Display hidden lines (;*HD*) in the G code editor Bit 6: Reserved Bit7: Deactivate G–program check (mold making)		

9478 MD number	$MM_TO_OPTION_MASK Settings for ShopMill		
Default setting: 1	Min. input limit: 0000	Max. input limit: FFFF	
Change becomes effective after: POWER ON	Protection level: 1	Units: Hex	
Data type: LONG		Valid as of software version ShopMill 7.5	
Significance:	Bit 0: Display tool parameter ”Number of teeth”, ”Spindle”, ”Cooling water” 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 Bit7: 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 data through addition. Bit 11: Reserved Bit 12: Disable loading and unloading at emergency off. Bit 13: Display buffer magazine in turning tool management. Bit 14: Reserved Bit 15: Disable loading/unloading tool on spindle. Bit 16: Reserved Bit 17: Hide softkey ”Relocate” in magazine list. Bit 18: Hide softkey ”Position” in magazine list. Bit 19: Reserved Bit 20: Always load tools directly on spindle. Bit 21: Display basic length for angle head mill in detailed image. Bit 22: Do not include measuring probe for the function ”Unload all”. Bit 23: Reserved Bit 24: Magazine positioning in the wear list. Bit 25: Magazine number is always displayed in the loading and relocation dialog.		

9479 MD number	$MM_TO_MAG_PLACE_DISTANCE **Distance between individual tool holders**		
Default setting: 0	Min. input limit: 0.0	Max. input limit: 10000.0	
Change becomes effective after: POWER ON	Protection level: 3/4	Units: mm	
Data type: DOUBLE		Valid as of software version ShopMill 6.3	
Significance:	You use this MD to specify the spacing between the individual tool holders for the graphical display of the tools and magazine locations in the tool management. 0 = The tools and magazine locations are not graphically displayed. Note: If there are several magazines with different spacing between the tool holders on the machine, the tools cannot be displayed proportionally to all magazines since there is only one setting option for the spacing.		

9480 MD number	$MM_MA_SIMULATION_MODE **Switch fast view on and off**		
Default setting: –1	Min. input limit: –1	Max. input limit: 2	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 6.4	
Significance:	This MD is used to specify whether fast view is always active. –1 = The ShopMill simulation is displayed. 0 = You can select between ShopMill simulation and fast view . 1 = Fast view is always displayed. 2 = If a program is smaller than the limit specified in the machine data 9481 $MM_STAND_SIMULATION_LIMIT, the ShopMill simulation is called, for larger programs the fast view.		

9481 MD number	$MM_MA_STAND_SIMULATION_LIMIT **Limit of the standard simulation in KB**		
Default setting: 200	Min. input limit: 200	Max. input limit: 2000000	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: INTEGER		Valid as of software version ShopMill 6.4	
Significance:	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	Min. input limit: –10000	Max. input limit: 10000	
Change becomes effective after: POWER ON	Protection level: 3/4	Units: mm	
Data type: LONG		Valid as of software version ShopMill 4.3	
Significance:	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	Min. input limit: –10000	Max. input limit: 10000	
Change becomes effective after: POWER ON	Protection level: 3/4	Units: mm	
Data type: LONG		Valid as of software version ShopMill 4.3	
Significance:	Reserved		

9604 MD number	$MM_CTM_SIMULATION_MAX_Y Simulation of maximum display Y		
Default setting: 0	Min. input limit: –10000	Max. input limit: 10000	
Change becomes effective after: POWER ON	Protection level: 3/4	Units: mm	
Data type: LONG		Valid as of software version ShopMill 4.3	
Significance:	Reserved		

9605 MD number	$MM_CTM_SIMULATION_MAX_VIS_AREA Simulation of maximum display area		
Default setting: 1000	Min. input limit: –10000	Max. input limit: 10000	
Change becomes effective after: POWER ON	Protection level: 3/4	Units: mm	
Data type: LONG		Valid as of software version ShopMill 4.3	
Significance:	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	Min. input limit: 0000	Max. input limit: FFFF	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: Hex	
Data type: WORD		Valid as of software version ShopMill 7.1	
Significance:	Bit 0: Free Bit 1: Display system messages from ShopMill in the dialog line (for diagnostics purposes only). Bit 2 to bit 12: Reserved Bit 13: Display cyclical lead time of ShopMill between 1st and 2nd vertical softkey (for diagnostics purposes only). Bit 14 to 16: Reserved		

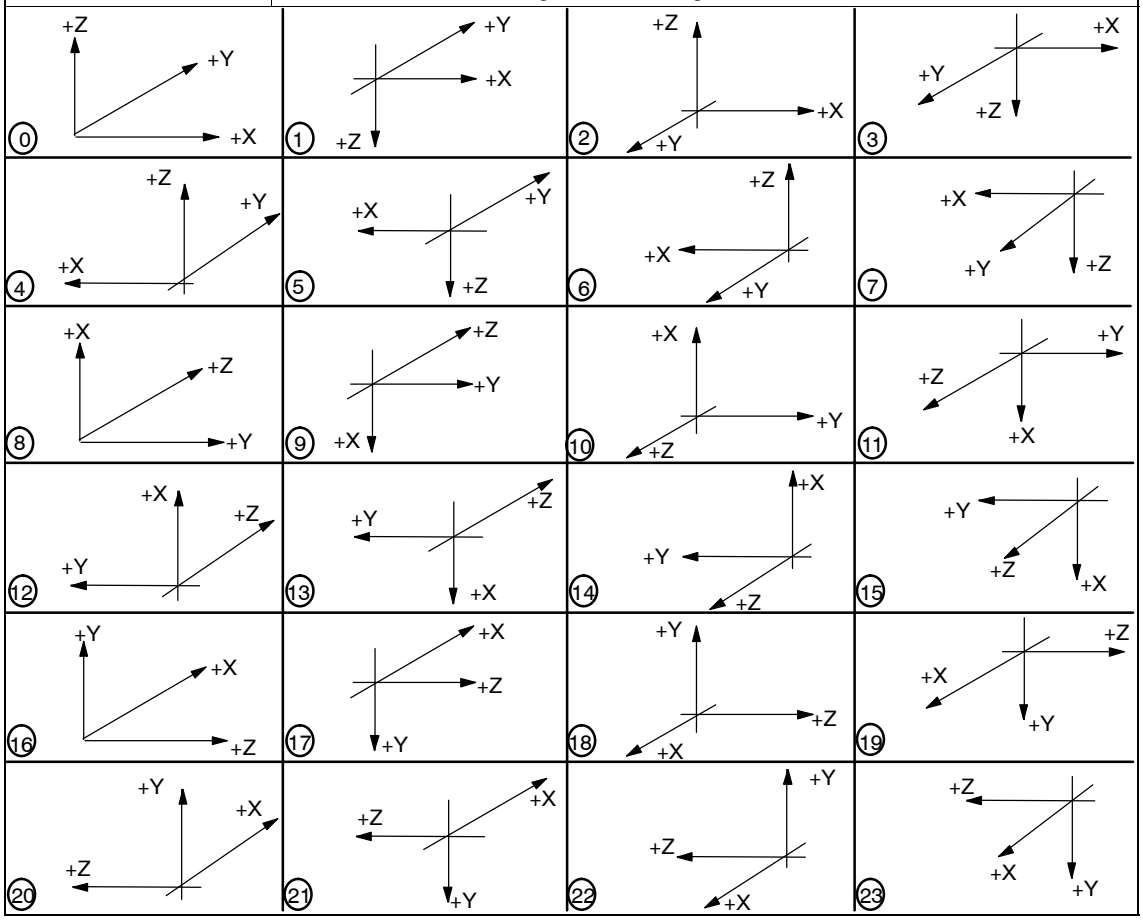
9639 MD number	$MM_CTM_MAX_TOOL_WEAR Upper input limit for tool wear		
Default setting: 1	Min. input limit: 0	Max. input limit: 10	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: mm	
Data type: DOUBLE		Valid as of software version: ShopMill 6.3	
Significance:	With this MD you 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	Min. input limit: 0	Max. input limit: 1	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version: ShopMill 6.4	
Significance:	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.		

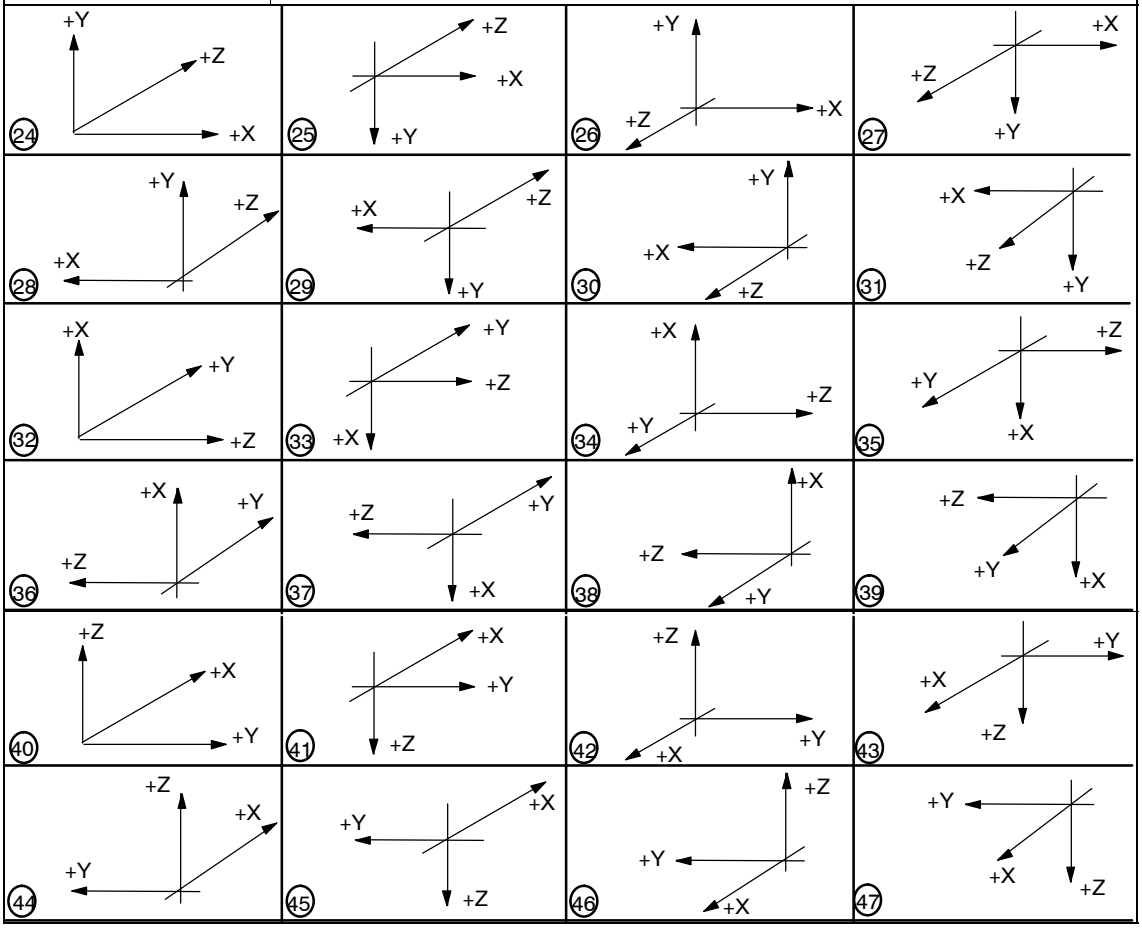
9646 MD number	**$MM_CTM_FACTOR_O_CALC_THR_PITCH** **Factor for calculating the external thread depth if pitch entered**		
Default setting: 0.6134	Min. input limit: –	Max. input limit: –	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: DOUBLE		Valid as of software version: ShopMill 6.4	
Significance:	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	Min. input limit: –	Max. input limit: –	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: DOUBLE		Valid as of software version: ShopMill 6.4	
Significance:	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	Min. input limit: 0	Max. input limit: 47	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 4.3	
Significance:	This MD is used to adapt the coordinates system of the operator interface to that of the machine. Depending upon the selected position, all help displays, process graphics, simulation and entry fields with circle direction data automatically change on the ShopMill user interface . The coordinate system can take on the positions listed below. Also note MD 9719 $MM_CMM_OPTION_MASK, bit 31. Examples: 0: Vertical milling machine 16: Horizontal milling machine, boring mill		



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	Min. input limit: 1	Max. input limit: 4
Change becomes effective after: POWER ON	Protection level: 3/4	Units: –
Data type: BYTE		Valid as of software version ShopMill 4.3
Significance:	Choice of two tool management variants: 2: Tool management without loading/unloading 4: Tool management with loading/unloading	

9652 MD number	$MM_CMM_TOOL_LIFE_CONTROL **Tool monitoring**	
Default setting: 1	Min. input limit: 0	Max. input limit: 1
Change becomes effective after: POWER ON	Protection level: 3/4	Units: –
Data type: BYTE		Valid as of software version ShopMill 4.3
Significance:	This MD is used to activate 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	Min. input limit: 0	Max. input limit: 3	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 4.3	
Significance:	Enable fourth 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	Min. input limit: 0	Max. input limit: 4	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 4.3	
Significance:	This MD is used to stipulate 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	Min. input limit: –1	Max. input limit: 100.0	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: mm	
Data type: DOUBLE		Valid as of software version ShopMill 4.3	
Significance:	This MD is used to determine the retraction distance for deep hole drilling with chip breaking. Note: –1 means that the value for the retraction distance can be entered on the operator interface (parameter ”V2”, return distance).		

9656 MD number	$MM_CMM_CYC_DRILL_RELEASE_DIST **Retraction distance for boring**		
Default setting: –1	Min. input limit: –1	Max. input limit: 10.0	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: mm	
Data type: DOUBLE		Valid as of software version ShopMill 4.3	
Significance:	This MD is used to determine the distance by which the tool moves free in X and Z direction for boring. Note: –1 means that the value of the retraction distance D can be entered on the operator interface.		

9657 MD number	$MM_CMM_CYC_MIN_CONT_PO_TO_RAD **Variation of smallest possible cutter radius in %**		
Default setting: 5	Min. input limit: 0	Max. input limit: 50	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: %	
Data type: WORD		Valid as of software version ShopMill 4.3	
Significance:	This MD is required for milling contour pockets. This parameter is used to stipulate the percentage by which the radius of the cutter being used may be smaller than the one used for generation.		

9658 MD number	$MM_CMM_CYC_MAX_CONT_PO_TO_RAD **Variation of largest possible cutter radius**		
Default setting: 0.01	Min. input limit: 0.0	Max. input limit: 10.0	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: mm	
Data type: DOUBLE		Valid as of software version ShopMill 4.3	
Significance:	This MD is required for milling contour pockets. This parameter is used to stipulate the amount by which the radius of the cutter being used may be larger than the one used for generation.		

9659 MD number	$MM_CMM_CYC_DRILL_RELEASE_ANGLE **Tool orientation angle on retraction**		
Default setting: –1	Min. input limit: –1	Max. input limit: 360	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: Degrees	
Data type: DOUBLE		Valid as of software version ShopMill 4.3	
Significance:	This MD is used to determine the spindle position (0...360^0) at which the tool, e.g. an internal turning tool, remains in a boring. Note: –1 means that the value for the tool orientation angle can be entered on the operator interface.		

9660 MD number	$MM_CMM_ENABLE_PLANE_CHANGE **Changing to machining plane (G17, G18, G19)**		
Default setting: 1	Min. input limit: 0	Max. input limit: 1	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 4.3	
Significance:	Enable change to machining plane (G17, G18, G19): 0 = Changing to machining plane (G17, G18, G19) not possible 1 = Changing to machining plane (G17, G18, G19) possible		

9662 MD number	$MM_CMM_COUNT_GEAR_STEPS **Number of gear stages**		
Default setting: 1	Min. input limit: 0	Max. input limit: 5	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 4.3	
Significance:	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	Min. input limit: 0	Max. input limit: 1	
Change becomes effective after: POWER ON	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 4.3	
Significance:	This MD is used to define how the tool should be displayed or entered: 0 = radius 1 = diameter		

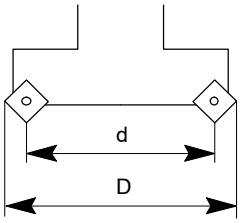
9664 MD number	$MM_CMM_MAX_INP_FEED_P_MIN **Maximum feed in mm/min**		
Default setting: 10000.0	Min. input limit: 0.0	Max. input limit: 100000.0	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: mm/min	
Data type: DOUBLE		Valid as of software version ShopMill 4.3	
Significance:	This MD is used to enter the upper limit for the feed rate input in mm/min.		

9665 MD number	$MM_CMM_MAX_INP_FEED_P_ROT **Maximum feed in mm/rev**		
Default setting: 1.0	Min. input limit: 0.0	Max. input limit: 10.0	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: mm/rev	
Data type: DOUBLE		Valid as of software version ShopMill 4.3	
Significance:	This MD is used to enter the upper limit for the feed rate input in mm/rev.		

9666 MD number	$MM_CMM_MAX_INP_FEED_P_TOOTH **Maximum feed in mm/tooth**		
Default setting: 1.0	Min. input limit: 0.0	Max. input limit: 5.0	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: mm/tooth	
Data type: DOUBLE		Valid as of software version ShopMill 4.3	
Significance:	This MD is used to enter the upper limit for the feed rate input in mm/tooth.		

9667 MD number	$MM_CMM_FOLLOW_ON_TOOL_ACTIVE **Tool preselection active**		
Default setting: 1	Min. input limit: 0	Max. input limit: 1	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 4.3	
Significance:	This MD is used to activate tool preselection in a magazine (e.g. chain magazine); i.e. the following tool is already brought to the loading point for a pending tool change. 0 = Tool preselection is not active 1 = Tool preselection is active		

9668 MD number	$MM_CMM_M_CODE_COOLANT_I_AND_II **M function coolant I and II**		
Default setting: –1	Min. input limit: –1	Max. input limit: 32767	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: WORD		Valid as of software version ShopMill 4.4	
Significance:	This MD is used to stipulate the M function if in the tools list coolants I and II are both active at the same time. 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	Min. input limit: 50.0	Max. input limit: 100.0	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: %	
Data type: DOUBLE		Valid as of software version ShopMill 4.4	
Significance:	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_POCKE **Radius of approach circle for finishing contour pockets plus half the final machining allowance (–1 = safety clearance)**		
Default setting: –1	Min. input limit: –1	Max. input limit: 100.0	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: mm	
Data type: DOUBLE		Valid as of software version ShopMill 4.4	
Significance:	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	Min. input limit: 0	Max. input limit: 30	
Change becomes effective after: POWER ON	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 6.3	
Significance:	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	Min. input limit: 0	Max. input limit: 1	
Change becomes effective after: POWER ON	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 4.4	
Significance:	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	Min. input limit: 1	Max. input limit: 2	
Change becomes effective after: POWER ON	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 4.4	
Significance:	This MD is used to stipulate the loading point at which the magazine and the spindle are loaded and unloaded. (The magazine and the spindle are always loaded/unloaded at 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	Min. input limit: 0	Max. input limit: 1	
Change becomes effective after: POWER ON	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 4.4	
Significance:	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	Min. input limit: 0	Max. input limit: 1	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 5.1	
Significance:	The customized boot screen is activated as follows: 0 = Siemens boot screen 1 = Customized boot screen		

9680 MD number	$MM_CMM_M_CODE_COOLANT_I M function coolant I		
Default setting: 8	Min. input limit: 0	Max. input limit: 32767	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: WORD		Valid as of software version ShopMill 5.1	
Significance:	This MD is used to stipulate the M function for coolant I; this is output when the tool is changed.		

9681 MD number	$MM_CMM_M_CODE_COOLANT_II M function coolant II		
Default setting: 7	Min. input limit: 0	Max. input limit: 32767	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: WORD		Valid as of software version ShopMill 5.1	
Significance:	This MD is used to stipulate the M function for coolant II; this 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	Min. input limit: 0	Max. input limit: 100	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: mm	
Data type: DOUBLE		Valid as of software version ShopMill 6.2	
Significance:	This MD defines the preboring depth for drill and thread milling.		

9686 MD number	$MM_CMM_M_CODE_COOLANT_OFF **M function for coolant OFF**		
Default setting: 9	Min. input limit: 0	Max. input limit: 32767	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: LONG		Valid as of software version ShopMill 6.2	
Significance:	This MD is used to stipulate the M function for switching the coolant OFF; this is output when the tool is changed.		

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

9688 MD number	$MM_CMM_COUNT_GEAR_STEPS_S2 **Number of gear stages for the 2nd spindle (front spindle)**		
Default setting: 1	Min. input limit: 0	Max. input limit: 5	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: LONG		Valid as of software version ShopMill 6.4	
Significance:	This MD is for setting the number of gear stages (0 to 5) for the front spindle. The possibility of input in the operator interface is thus restricted.		

9703 MD number	$MM_CMM_INDEX_AXIS_4 **Axis index for 4th axis**		
Default setting: 0	Min. input limit: 0	Max. input limit: 127	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: UBYTE		Valid as of software version ShopMill 5.3	
Significance:	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	Min. input limit: 0	Max. input limit: 127	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: UBYTE		Valid as of software version ShopMill 5.3	
Significance:	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	Min. input limit: 0	Max. input limit: 127	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: UBYTE		Valid as of software version ShopMill 5.3	
Significance:	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	Min. input limit: 0	Max. input limit: 3	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 6.4	
Significance:	In this MD, the 4th axis is assigned a geometry axis. The assignment becomes necessary if you are using the angle offset parameter when measuring a workpiece. 0 = no assignment 1 = 4th axis in the direction of the 1st geometry axis (X) –> A axis 2 = 4th axis in the direction of the 2nd geometry axis (Y) –> B axis 3 = 4th axis in the direction of the 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	Min. input limit: 0	Max. input limit: 3	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 6.4	
Significance:	In this MD, the 5th axis is assigned a geometry axis. The assignment becomes necessary if you are using the angle offset parameter when measuring a workpiece. 0 = no assignment 1 = 5th axis in the direction of the 1st geometry axis (X) –> A axis 2 = 5th axis in the direction of the 2nd geometry axis (Y) –> B axis 3 = 5th axis in the direction of the 3rd geometry axis (Z) –> C axis		

9708 MD number	$MM_CMM_INDEX_SPINDLE_2 **Axis index for 2nd spindle (front spindle)**		
Default setting: 0	Min. input limit: 1	Max. input limit: 127	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 6.4	
Significance:	The number of the channel axis for the front axis is entered in this MD.		

9718 MD number	$MM_CMM_OPTION_MASK_2 Settings for ShopMill		
Default setting: 0	Min. input limit: 0000	Max. input limit: FFFF	
Change becomes effective after: IMMEDIATELY	Protection level: 1	Units: Hex	
Data type: LONG		Valid as of software version ShopMill 7.1	
Significance:	Bit 0: Do not jump to Automatic mode when an external program (from the PLC) is selected for execution. Bit 1: Influence the simulation speed through feed rate override. Bit 2: Do not display the basic offset in the measuring and program mask and cannot be entered. Bit 3 to bit 6: Reserved Bit7: Deactivate the function approaching and departing along the software limit switches for the swivel heads. Bit 8: Reserved Bit 9 to 12: Reserved Bit 13: The correction angle is inverted during boring (E_DE_BOR).		

9719 MD number	$MM_CMM_OPTION_MASK Settings for ShopMill		
Default setting: H5	Min. input limit: 0000	Max. input limit: FFFF	
Change becomes effective after: IMMEDIATELY	Protection level: 1	Units: Hex	
Data type: LONG		Valid as of software version ShopMill 6.4	
Significance:	Bit 0 to bit 8: Reserved Bit 9: Start program execution in all screens. Bit 10 to 11: Reserved Bit 12: Display of all axes (up to 14 axes) Bit 13 to bit 17: Reserved Bit 18: When changing Manual/MDA/Auto, change the mode but not the ShopMill 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 record 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 coordinates system for G17 as follows: X to right, Y up (right–handed coordinates system) or down (left–handed coordinates system).		

9720 MD number	$MM_CMM_ENABLE_B_AXIS Enable 5th axis for operator interface		
Default setting: 0	Min. input limit: 0	Max. input limit: 3	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 5.1	
Significance:	5. Enable fifth 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	Min. input limit: 0	Max. input limit: 1	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 5.1	
Significance:	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	Min. input limit: 0	Max. input limit: 1	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 5.1	
Significance:	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 feed for positioning on circular path**		
Default setting: 5000	Min. input limit: 0	Max. input limit: 100000	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: mm/min	
Data type: DOUBLE		Valid as of software version ShopMill 6.2	
Significance:	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	Min. input limit: –	Max. input limit: –	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 6.4	
Significance:	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	Min. input limit: –	Max. input limit: –	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 6.4	
Significance:	This MD is used to determine whether the angle of the A/B axis can also be directly programmed for position samples. 0 = no support of A/B axis for position samples > 0 = support of A axis for position samples, amount = number of channel axis < 0 = support of B axis for position samples, amount = 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	Min. input limit: 0	Max. input limit: 1	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 6.4	
Significance:	With this MD, you can adapt the displayed and executed direction of rotation to the commissioning of the machine axes. The observation of the direction of rotation is carried out in the direction of the positive coordinate axis. 0 = right (to DIN) 1 = left		

9729 MD number	$MM_CMM_G_CODE_TOOL_CHANGE_PROG **Program name for tool change in the G code**		
Default setting: –	Min. input limit: –	Max. input limit: –	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: STRING (24)		Valid as of software version ShopMill 6.4	
Significance:	This MD is used to stipulate the program name for 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.		

9739 MD number	$MM_CMM__M_CODE_TOOL_FUNC_1_ON **M code for tool–specific function 1 ON**		
Default setting: –1	Min. input limit: – 1	Max. input limit: 32767	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: LONG		Valid as of software version ShopMill 7.1	
Significance:	This MD is used to define an M command for tool–specific function 1. The value –1 means that the M function is not output. If both M commands of function 1 =–1, the corresponding field is not displayed on the interface.		

9740 MD number	$MM_CMM__M_CODE_TOOL_FUNC_1_OFF M code for tool–specific function 1 OFF		
Default setting: –1	Min. input limit: – 1	Max. input limit: 32767	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: LONG		Valid as of software version ShopMill 7.1	
Significance:	This MD is used to define an M command for tool–specific function 1. The value –1 means that the M function is not output. If both M commands of function 1 =–1, the corresponding field is not displayed on the interface.		

9741 MD number	$MM_CMM__M_CODE_TOOL_FUNC_2_ON M code for tool–specific function 2 ON		
Default setting: –1	Min. input limit: – 1	Max. input limit: 32767	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: LONG		Valid as of software version ShopMill 7.1	
Significance:	This MD is used to define an M command for tool–specific function 2. The value –1 means that the M function is not output. If both M commands of function 2 =–1, the corresponding field is not displayed on the interface.		

9742 MD number	$MM_CMM__M_CODE_TOOL_FUNC_2_OFF M code for tool–specific function 2 OFF		
Default setting: –1	Min. input limit: – 1	Max. input limit: 32767	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: LONG		Valid as of software version ShopMill 7.1	
Significance:	This MD is used to define an M command for tool–specific function 2. The value –1 means that the M function is not output. If both M commands of function 2 =–1, the corresponding field is not displayed on the interface.		

9743 MD number	$MM_CMM__M_CODE_TOOL_FUNC_3_ON M code for tool–specific function 3 ON		
Default setting: –1	Min. input limit: – 1	Max. input limit: 32767	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: LONG		Valid as of software version ShopMill 7.1	
Significance:	This MD is used to define an M command for tool–specific function 3. The value –1 means that the M function is not output. If both M commands of function 3 =–1, the corresponding field is not displayed on the interface.		

9744 MD number	$MM_CMM__M_CODE_TOOL_FUNC_3_OFF M code for tool–specific function 3 OFF		
Default setting: –1	Min. input limit: – 1	Max. input limit: 32767	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: LONG		Valid as of software version ShopMill 7.1	
Significance:	This MD is used to define an M command for tool–specific function 3. The value –1 means that the M function is not output. If both M commands of function 3 =–1, the corresponding field is not displayed on the interface.		

9745 MD number	$MM_CMM__M_CODE_TOOL_FUNC_4_ON M code for tool–specific function 4 ON		
Default setting: –1	Min. input limit: – 1	Max. input limit: 32767	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: LONG		Valid as of software version ShopMill 7.1	
Significance:	This MD is used to define an M command for tool–specific function 4. The value –1 means that the M function is not output. If both M commands of function 4 =–1, the corresponding field is not displayed on the interface.		

9746 MD number	$MM_CMM__M_CODE_TOOL_FUNC_4_OFF M code for tool–specific function 4 OFF		
Default setting: –1	Min. input limit: – 1	Max. input limit: 32767	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: LONG		Valid as of software version ShopMill 7.1	
Significance:	This MD is used to define an M command for tool–specific function 4. The value –1 means that the M function is not output. If both M commands of function 4 =–1, the corresponding field is not displayed on the interface.		

9748 MD number	$MM_CMM_MKS_POSITION_MAN_MEAS Position man. tool measurement with fixed point		
Default setting: 0	Min. input limit: –	Max. input limit: –	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: mm	
Data type: DOUBLE		Valid as of software version ShopMill 6.4	
Significance:	This MD is used to define the position of the fixed point in the machine coordinate system if a fixed point must be used as reference point for manual tool measuring. The position of the fixed point can also be determined via the function ”Manual machine” → ”Measuring tool” → ”Adjusting 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	Min. input limit: –	Max. input limit: –	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: BYTE		Valid as of software version ShopMill 6.4	
Significance:	This MD is used to define the display of the runtimes. Bit 0: Program progress display Bit 1: Display time Bit 2: Display date Bit 3: Display machine runtime Bit 4: Display processing time Bit 5: Display utilization Bit 6: Display program repeats		

Note

For a description of the display machine data for measuring cycles, please refer to Section 9.1.2 ”Display machine data measuring cycles”.

9855 MD number	**$MM_ST_CYCLE_TAP_SETTINGS** **Thread tapping setting with and without compensation chuck**		
Default setting: 0	Min. input limit: –	Max. input limit: –	
Change becomes effective after: IMMEDIATELY	Protection level: 3/4	Units: –	
Data type: WORD		Valid as of software version ShopMill 6.3	
Significance:	For thread tapping without compensation chuck Units digit: Exact response 0: Exact stop response active as before cycle call 1: Exact stop G601 2: Exact stop G602 3: Exact stop G603 Tens digit: Feed–forward control 0: With/without feed–forward control active as before cycle call 1: With feed–forward control FFWON 2: Without feed–forward control FFWOF Hundreds digit: Acceleration 0: SOFT/BRISK/DRIVE active as before cycle call 1: With jerk limiting SOFT 2: Without jerk limiting BRISK 3: Reduced acceleration DRIVE Thousands digit: MCALL 0: For MCALL Reactivate spindle operation 1: Remain in position control for MCALL For thread tapping with compensation chuck (see chapter 11.4 Analog spindles) Units digit: Exact response 0: Exact response as before cycle call 1: Exact response G601 2: Exact stop G602 3: Exact stop G603 Tens digit. Feed–forward control 0: With/without feed–forward control active as before cycle call 1: With feed–forward control FFWON 2: Without feed–forward control FFWO Hundreds digit: Brake application point 0: Without calculation 1: With calculation		

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

■

Space for your notes

Tool Management

8

8.1 Overview of functions

Option

ShopMill only runs when the tool management option is set. This is contained within the ShopMill
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 NCK. All data can be read and written by manual entry, via the 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 120 mm”.
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 NCK and PLC.

Tools

For ShopMill on NCU (HMI Embedded sl), a maximum number of 250 tools can be created. For PCU 50.3 (HMI Advanced), the maximum number of tools is limited by MD 18082 $MN_MM_NUM_TOOL.
9 cutting edges each can be defined for each tool.

Replacement tools

Maximum 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. The magazine list can be hidden via the display MD 9674 $MM_CMM_ENABLE_TOOL_MAGAZINE.

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 variant can be used for machines with chain magazine.
  Individual tools can be set to fixed location coding on the operator 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 number (DP).
The tool monitoring can be deactivated via the display MD 9652 $MM_CMM_TOOL_LIFE_CONTROL.
The wear monitoring is activated via the MD 18080, bit 5.

Tool management without loading/ unloading

Tool management without the load/unload softkey can be set by means of value 2 in display MD 9651 $MM_CMM_TOOL_MANAGEMENT.

Tool management with loading/ unloading

Tool management with the load/unload softkey can be set by means of value 4 in display MD 9651 $MM_CMM_TOOL_MANAGEMENT.

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 list and the tool wear list according to magazine location, name, type, and tool number.

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

- Loading/unloading 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

Modifying 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 Commissioning sequence

You can either commission tool management together with ShopMill commissioning (see Section 4.2 ”First Commissioning Sequence”) or subsequently.

To commission tool management, proceed as follows:

1. NCK commissioning
2. PLC commissioning
3. Adapt display machine data
4. Create tool–changing cycle

If your machine already features a tool management, you do not have to install a separate tool management for ShopMill. That is, the commissioning of NCK, PLC and tool–changing cycle is omitted, only the display machine data have to be adapted.

For a precise description of tool management commissioning, please refer to:
References: /FBIW/, Description of Functions Tool Management

Note

With PCU 50.3 you can also commission tool management (generating configuration file and PLC data) via the CNC–ISO operator interface.

References: /FBW/, Description of Tool Management Functions

8.3 Commissioning in NCK

Requirements

- PCU commissioning is performed and the connection to the NCK established.
- NCK commissioning is carried out with the default machine data.

Implementation

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

8.3.1 Entry of NCK machine data

In order to use tool management the machine data for memory setting and for activating tool management must be set.

Machine data for memory setting

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

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.
You can simply specify approximately how many cutting edges you will need in total.

Example

Allocation of machine data for use with a dual gripper so that manual tools can be applied even with a completely allocated magazine (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 Section 8.3.3 ”Creating and Loading the Configuration File”).

Modifying the ”memory–influencing” machine data also reformats the battery–backed RAM. Data must therefore be backed up in advance.

Machine data for activating tool management

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

MD 20310	Channel–specific activation of TM
MD 20320	Activation of tool life monitoring for the listed spindle
MD 22550	New tool offset for M function
MD 22560	M function for tool change
MD 22562	Error response for 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

For a detailed description of the NCK machine data of the tool management, see the following chapter 8.3.2 ”Description of NCK machine data for tool management”.

8.3.2 Description of NCK machine data

18080	**MM_TOOL_MANAGEMENT_MASK**		
MD number	Activate the memory for tool management		
Default setting: 0x0	Min. input limit: 0	Max. input limit: 0xFFFF	
Change becomes effective after: POWER ON	Protection level: 1/4	Units: HEX	
Data type: DWORD	Valid as of software version: 4.3		
Significance:	Activation of the tool management memory with ”0” means: The tool management data set does not occupy any memory; tool management is not available. Bit 0=1: Memory for data specific to tool management is available; the MDs for reserving memory must be set accordingly (18086 MM_NUM_MAGAZINE_LOCATION, 18084 MM_NUM_MAGAZINE) Bit 1=1: Memory is available for monitoring data Bit 2=1: Memory is available for user data (CC data) Bit 3=1: Memory is available for considering the adjacent location Bit 4=1: Memory and function release for PI service _N_TSEARC = ”Complex search for tools in magazine” is available. 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 magazine location adapters Bit 8=1: Memory for operation and/or setup corrections Bit 9=1: Tools in a turret no longer vacate their turret location on 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 available MD = 1 means tool management without tool monitoring data		

18082	**MM_NUM_TOOL**		
MD number	Number of tools the NCK can manage		
Default setting: 40	Min. input limit: 0	Max. input limit: 600	
Change becomes effective after: POWER ON	Protection level: 2/4	Units: —	
Data type: DWORD	Valid as of software version: 2.		
Significance:	The number of tools which the NCK can manage is entered here. The maximum number of tools equals the number of cutting edges in the NCK. Battery–backed memory is reserved for the number of tools.		
Additional references	Description of functions: Memory Configuration (S7), Tool Offset (W1)		

18084 MD number	**MM_NUM_MAGAZINE** Number of magazines the NCK can manage		
Default setting: 3	Min. input limit: 0	Max. input limit: 32	
Change becomes effective after: POWER ON	Protection level: 2/4	Units: —	
Data type: DWORD	Valid as of software version: 2.		
Significance:	Number of magazines that the NCK can manage (active and background magazines). This MD is 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: Tool management cannot be active because no data can be created.		
Additional references	Description of functions: Memory configuration (S7)		

18086 MD number	**MM_NUM_MAGAZINE_LOCATION** Number of magazine locations the NCK can manage		
Default setting: 35	Min. input limit: 0	Max. input limit: 600	
Change becomes effective after: POWER ON	Protection level: 2/4	Units: —	
Data type: DWORD	Valid as of software version: 2.		
Significance:	Number of magazines the NCK can manage. This MD reserves the battery–backed memory for the magazine locations. Important: The locations in the intermediate memory and a loading magazine must be taken into account. Value = 0: Tool management cannot be active because no data can be created.		
Additional references	Description of functions: Memory Configuration (S7)		

18100 MD number	**MM_NUM_CUTTING_EDGES_IN_TOA** Number of tool cutting edges per TOA block		
Default setting: 80	Min. input limit: 0	Max. input limit: 1500	
Change becomes effective after: POWER ON	Protection level: 2/4	Units: —	
Data type: DWORD	Valid as of software version: 2.		
Significance:	This MD is used to stipulate the number of cutting 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. The following minimum requirements apply: MM_NUM_TOOL = 10 MM_NUM_CUTTING_EDGES_IN_TOA = 20 See also MM_NUM_TOOL Special cases: If this machine data is altered the buffered data is lost. References: /FBW/, "Description of Tool Management Functions"		
Additional references	Description of functions: Memory Configuration (S7)		

20310 MD number	**TOOL_MANAGEMENT_MASK** Channel–specific activation of tool management		
Default setting: 0x0, ...	Min. input limit: 0	Max. input limit: 0xFFFFF	
Changes effective after POWER ON	Protection level: 2/4	Units: HEX	
Data type: DWORD	Valid as of software version: 2		

Significance:

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 acknowledged by the PLC program

Bit 5=1: When the tool command is output the main run of the main spindle can be stopped within one OB1 cycle (e.g. by read–in halt).

Bit 5=0: When the command is output to the PLC the main run of the main spindle is resumed.

Bit 6=1: When the tool command is output the main run of the auxiliary spindle can be stopped within one OB1 cycle (e.g. by read–in halt).

Bit 6=0: When the command is output to the PLC the main run of the main spindle is resumed.

Bit 7=1: The main run of the main spindle is halted until acknowledgment with status 1 is received via FC7, FC8.

Bit 7=0: When the command is output to the PLC the main run of the main spindle is resumed.

Bit 8=1: The main run of the auxiliary spindle is halted until acknowledgment with status 1 is received via FC7, FC8.

Bit 8=0: When the command is output to the PLC the main run of the auxiliary spindle is resumed.

Bit 9: Reserved 10=1: M06 is delayed until ”prepare change” is received via FC8 (status 1) from the PLC.
The change signal (e.g. M06) is only output when tool selection (DBX [n+0].2) is acknowledged. The part program is halted with M06 until tool selection is acknowledged.

Bit 10=0: The tool change ON command NCK –> PLC is not output until the PLC preparation acknowledgment has been received. This is relevant for PLC command 3 (i.e. programming of M06 in a block containing no T).

Bit 11=1: The preparation 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 ''
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 preparation command can be output only once for a tool..

Bit 12=1: The preparation command is executed 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 once for the same tool. (Tx...Tx)

Bit 12=0: The preparation 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
Significance:	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 part program). 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 preparation commands (Tx–>Tx). This method of function activation permits various combinations. Example for default activation of 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 itself. 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: On PLC signal ”program testing active” the commands generated are output to the PLC. In so doing. depending on the type of PLC acknowledgment, tool/magazine data in the NCK may be altered. If the acknowledgment parameters for the target magazine are set with the same values as the source magazine, the tool is not transported and thus no data is 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 and selection parameter. On transition to replacement tool only those tools in the tool group are recognized as replacement tools that in the $TC_TP11–value have at least one bit of the tool set to the programmed location. Bit 23=0 Default setting Tool management selects the tool in the main run with optimum certainty; i.e. the interpreter must, if correction is required, wait for the end of tool selection. Bit 23=1 For single applications the interpreter selects the tool itself; i.e. if correction is required, no synchronization with the main run is needed. (If after selection but before loading the tool becomes no longer usable, a non–correctable alarm may result.)

20320 MD number	TOOL_TIME_MONITOR_MASK Activation of tool life monitoring for the spindle here specified		
Default setting: 1/2	Min. input limit: 1	Max. input limit: 4	
Change becomes effective after: POWER ON	Protection level: 2/4	Units: —	
Data type: DWORD	Valid as of software version: 2		
Significance:	Value = 1: Monitoring is carried out for spindle 1. Value = 2: Monitoring is carried out for spindle 1 and spindle 2.		
Additional references	Description of functions: Memory Configuration (S7)		

22550 MD number	TOOL_CHANGE_MODE New tool offset for M function		
Default setting: 0	Min. input limit: 0	Max. input limit: 1	
Change becomes effective after: POWER ON	Protection level: 2/4	Units: —	
Data type: BYTE	Valid as of software version: 1.1		
Significance:	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		
Additional references	Description of functions: Coordinate Systems (K2)		

22560 MD number	TOOL_CHANGE_M_CODE M function for tool change		
Default setting: 6	Min. input limit: 0	Max. input limit: 9999 9999	
Changes effective after POWER ON	Protection level: 2/4	Units: –	
Data type: DWORD	Valid as of software version: 1.1		
Significance:	This MD is only effective if MD 22550 TOOL_CHANGE_MODE = 1. If the T function is used only to prepare a new tool for a tool change (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 tool change must be initiated with an additional 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		
Additional references	Description of functions: Tool Offset (W1)		

22562 MD number	**TOOL_CHANGE_ERROR_MODE** Error reaction with programmed tool change		
Default setting: 0	Min. input limit: 0	Max. input limit: 3	
Changes effective after POWER ON	Protection level: 2/4	Units: –	
Data type: DWORD	Valid as of software version: 5.1		
Significance:	If MD 22550 is set to 0, the default setting of MD 22562 should not be altered. Bit 0=0: Standard response: The stop occurs on the NC record where the error occurred. Bit 0=1: If the error occurs in the record with the tool change preparation, the alarm concerning the preparation command (T) is ignored until the corresponding tool preparation command (M06) is being interpreted in the program flow. At that time, the alarm is issued that was initiated by the preparation command. It is therefore not possible for the user to make corrections until this block is reached. Bit0 = 1: With active tool management only: In preparing tool changes, the NCK detects only tools with data assigned to a magazine. Bit1 = 1: Only with active tool management: The NCK even loads a tool whose data are known in the NCK, but which are not assigned to a magazine. In this case, the NCK attempts to automatically assign the tool data to the programmed spindle location. In case of several loadable tools, an active tool is searched 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 results in offset zero active DL no. > 0 and active D no. = 0 results in total offset zero Bit 2 = 1 active D no. > 0 and active T no. = 0 results in an alarm message active DL no. > 0 and active D no. = 0 results in 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		
Additional references	Description of functions: Tool Offset (W1)		

8.3.3 Creating and loading the configuration file

A configuration file must be created and loaded in the NCK for the commissioning of tool management.

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 to match 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

Transfer the configuration file to the NCK.

Examples

The following examples are contained in the toolbox under \ShopMill_Turn:

- 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 loading 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 loading 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 maga-
zine
                       ; 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 loca-
tion)
$TC_MPP2[1,1]=1        ; Location type
$TC_MPP3[1,1]=1        ; Adjacent location view (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       ; Adjacent location view (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: magazine location)
$TC_MPP2 [1.3]=1       ; Location type
$TC_MPP3 [1.3]=1       ; Adjacent location view (1: on)
$TC_MPP4 [1,3]=2       ; Location status (2: Location free)
$TC_MPP5 [1,3]=3       ; Location type index (3: Location no. 3)
.
.
.

; Location no. 29
$TC_MPP1 [1,29]=1      ; Location type (1: magazine location)
$TC_MPP2 [1.29]=1      ; Location type
$TC_MPP3 [1.29]=1      ; Adjacent location view (1: on)
$TC_MPP4 [1,29]=2      ; Location status (2: Location free)
$TC_MPP5 [1,29]=29     ; Location type index (29: Location no. 29)

; Location no. 30
$TC_MPP1 [1,30]=1      ; Location type (1: magazine location)
$TC_MPP2 [1.30]=1      ; Location type
$TC_MPP3 [1.30]=1      ; Adjacent location view (1: on)
$TC_MPP4 [1,30]=2      ; Location status (2: Location free)
$TC_MPP5 [1,30]=30     ; Location type index (30: Location 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: Location 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: Location 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: Location 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    ; Adjacent location view
$TC_MPP4 [9999,1]=2    ; Location status (2: Location free)
$TC_MPP5 [9999,1]=1    ; Location type index (1: Location 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    ; Adjacent location view
$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: Revolver
- 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 tool designation (1)
- Bit 1: Search for next tool with tool 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 = loading point

Default: Value corresponding to 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 at the location.
Buffers and loading points have the value 0!

Consider adjacent location $TC_MPP3

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

- Value = 1: An adjacent location is considered for the location specified
- Value = 0: No adjacent location is considered for the location specified
- Value = 0: This 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 Commissioning in the PLC

Requirements

- PCU commissioning is performed and the connection to the NCK established.
- The NCK commissioning with NCK machine data for the tool management is performed.
- The basic PLC program is loaded.

General

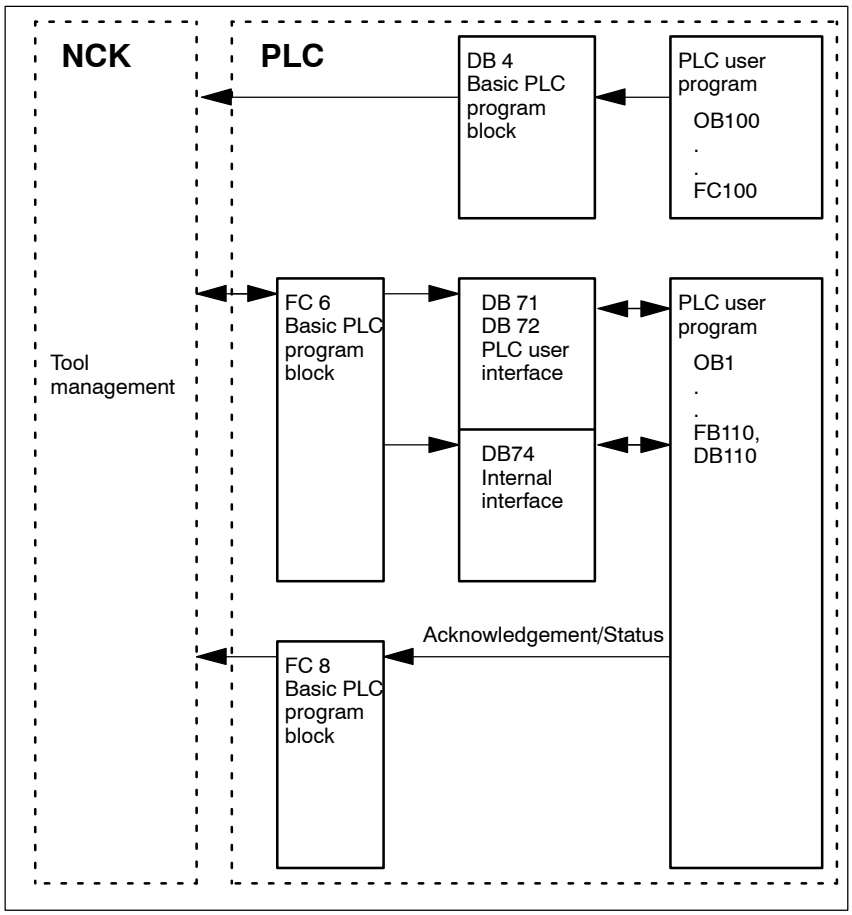


Fig. 8-1 Overview of tool management

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 tool management in DB4.
DB4 is written to by the PLC user program.
FC100 is provided as an example.

Implementation

Implement call FC 8 and create PLC data (DB4).
For this purpose, either adjust the blocks FC 100 and FB110 in the directory \ShopMill_Turn or use your own blocks.

8.4.1 Example for FC 100 and FB 110

The AWL sources TM_W.AWL and TM_WO.AWL are available as examples for the tool management in the directory \ShopMill_Turn.

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 PLC data for tool management to DB4.

The PLC data is set up for 2 loading points (DB71) and a spindle (DB72).
The signals for DB71 and DB72 are found in Chapter 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 loading 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 acknowledgment 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 performed by means of interface signals from the tool management data blocks; each of these can be skipped.

Data transfer without dual gripper

FB 110 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 FB 110 from TM_WO_GR.AWL

Signal	Type	Default	Comment
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 loading point 1
Unload_IF1	BOOL	TRUE	Acknowledge unloading for loading point 1
Relocate_IF1	BOOL	TRUE	Acknowledge relocation for loading point 1
Position_IF1	BOOL	TRUE	Acknowledge positioning to loading point 1
Reset_IF_IF2	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

FB110 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 FB110 from TM_W_GR.AWL

Signal	Type	Default	Comment
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
Position_IF1	BOOL	TRUE	Acknowledge positioning to loading point 1
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 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 for 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 loading 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 on PLC								Load/unload without moving magazine

Initial addresses of load/unload locations:

Loading/unloading 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 loading station/point
len = 30 (length of a loading 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 observed for the loading interface assignment (applies to ShopMill on NCU (HMI Embedded sl)); it is automatically considered for PCU 50.3). 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 on left (Int)							
DBW n + 32	New tool: Size on right (Int)							
DBW n + 34	New tool: Size at top (Int)							
DBW n + 36	New tool: Size at bottom (Int)							
DBW n + 38	Tool status for new tool							
	Tool has been used	Tool with fixed loc. code		Prewarning limit reached	Measure tool		Enable tool	Active tool
DBW n + 40	New tool: Internal T number 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	Spare							
DBW n + 46	Spare							

Initial addresses of spindles:	Spindle 1: n = 4 Spindle 2: n = 52 Spindle 3: n = 100
n = (m–1)* len + 4	m = Location number 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
Description	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 software version: 2
Description	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
Description	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	
Description	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	
Description	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	
Description	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	
Description	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	
Description	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 commissioning 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	
Description	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	
Description	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
Description	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
Description	Number of location to which old tool must be loaded.		
Corresponding to...	DBW(n+26)		

DB 72 **DBW(n+28)** Data block	**New tool: Location type** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Description	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	**New tool: Size left** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Description	Specification of new tool size **on left** in half locations.		

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

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

DB 72 **DBW(n+36)** Data block	**New tool: Size bottom** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Description	Specification of new tool size **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
Description	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 has been in use		

DB 72 **DBW(n+40)** Data block	**New tool: Internal T no. of NCK** Signal(s)		
Edge evaluation:		Signal(s) updated: Conditional	Signal(s) valid from SW: 2
Description	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:
Description			

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

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

8.5 Display machine data

Display machine data can be used to activate certain functions and settings at the operator interface.

MD 9450 $MM_WRITE_TOA_FINE_LIMIT
Limit value for fine wear

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 point

MD 9674 $MM_CMM_ENABLE_TOOL_MAGAZINE
Display of magazine list

MD 9687 $MM_CMM_TOOL_MOVE_DEFAULT_MAG
Relocate 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

Process

The ShopMill tool change cycle performs the following tasks:

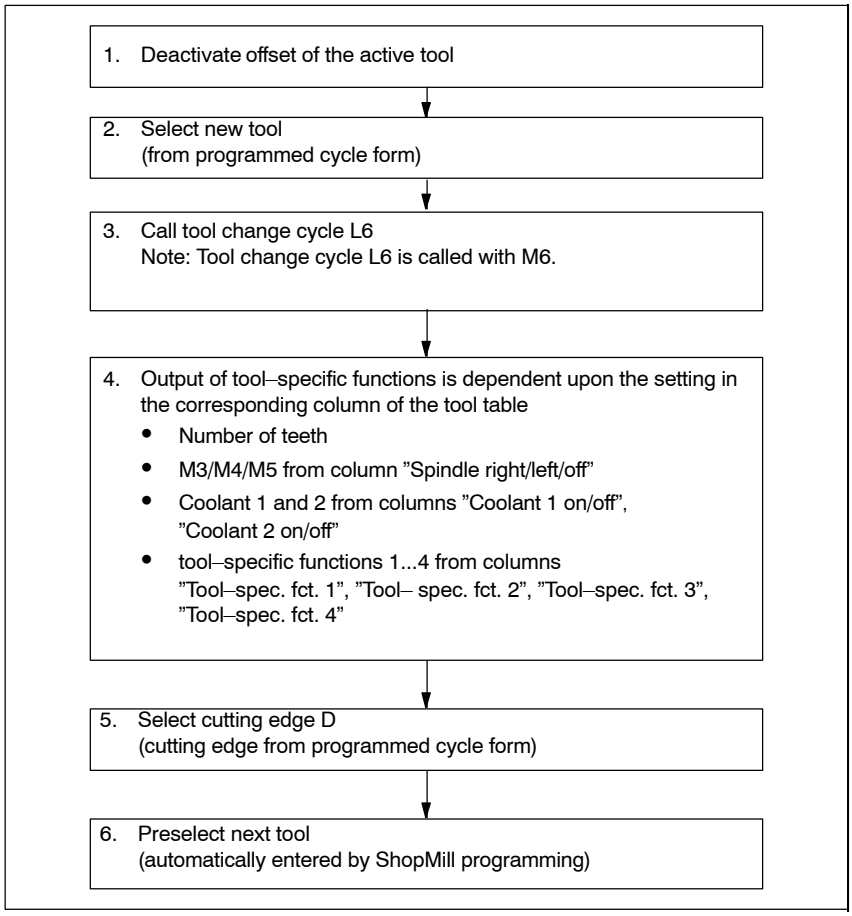


Fig. 8-2 ShopMill tool change cycle

Note

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

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

Example

The example L6.SPF is available for this purpose. The sample file is located in the directory CYCLES\SC\PROG\TEMPLATES_DEU or CYCLES\SC\PROG\TEMPLATES_ENG.
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) with which the tool change, i.e. the subroutine assigned via MD 10716 $MN_M_NO_FCT_CYCLE_NAME[0], is called.
- MD 10716 $MN_M_NO_FCT_CYCLE_NAME[0]="L6"
  Name of the subroutine (L6) that must be processed based on the M function defined in MD 10715.
  If the subroutine name must be entered via program or MDA, the name must be placed in quotes. 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.

```
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 tool holder 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 a direction of rotation (CW/CCW/OFF) and coolant to a tool.

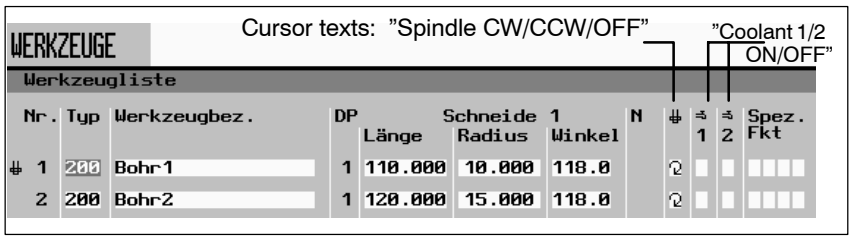


Fig. 8-3 Tool list: Coolant and direction of spindle rotation

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.

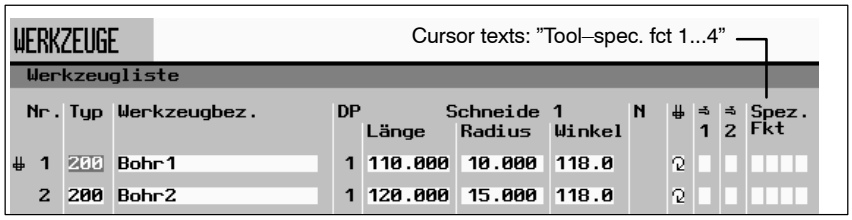


Fig. 8-4 Tool list: Tool–specific functions 1...4

Up to 8 M functions can be programmed for the activation or deactivation of the tool–specific functions. The definition occurs via the following machine data:

MD 9739 $MM_CMM_M_CODE_TOOL_1_ON
MD 9740 $MM_CMM_M_CODE_TOOL_1_OFF
MD 9741 $MM_CMM_M_CODE_TOOL_2_ON
MD 9742 $MM_CMM_M_CODE_TOOL_2_OFF
MD 9743 $MM_CMM_M_CODE_TOOL_3_ON
MD 9744 $MM_CMM_M_CODE_TOOL_3_OFF
MD 9745 $MM_CMM_M_CODE_TOOL_4_ON
MD 9746 $MM_CMM_M_CODE_TOOL_4_OFF

The M functions for the tool–specific functions are generated by the ShopMill cycles in a single record (up to 4 M commands are possible). The number and also the sequence of the M commands are dependent upon the machine data settings (MD9739 – MD9746) and the programming.
With machine data setting "–1", no M command is issued for the corresponding tool–specific function. The same applies if no entry (neither "on" nor "off") is made during programming in the menu "Programs" –> "Line/circle" –> "Machine functions".

If M functions smaller than 100 are used, the number and sequence of M commands is irrelevant since they are available in the operator PLC in the decoded area (DB21.DBB194 – DB21.DBB206), regardless of the number and he sequence during programming.

However, if M functions above 100 are used, they must be decoded in the operator PLC. In this case, the number and the sequence (M function 1 – M function 4) must be observed.

The display machine data are predefined so that no M values are output for the corresponding functions. For example, only the "On" statuses can be output via separate M commands and "Off" via a joint M command.

Example

Machine data settings:
MD 9739 $MM_CMM_M_CODE_TOOL_1_ON : 90
MD 9740 $MM_CMM_M_CODE_TOOL_1_OFF : 91
MD 9741 $MM_CMM_M_CODE_TOOL_2_ON : 92
MD 9742 $MM_CMM_M_CODE_TOOL_2_OFF : –1
MD 9743 $MM_CMM_M_CODE_TOOL_3_ON : 94
MD 9744 $MM_CMM_M_CODE_TOOL_3_OFF : 95
MD 9745 $MM_CMM_M_CODE_TOOL_4_ON : 96
MD 9746 $MM_CMM_M_CODE_TOOL_4_OFF : 97

The following functions are programmed in the menu Programs" → "Line/circle" → "Machine functions".
Tool–specific function 1: on
Tool–specific function 2: off
Tool–specific function 3: not programmed
Tool–specific function 4 : off

The ShopMill interface generates the following M functions:
M90 M97

Hiding fields in tool list

The fields in the tool list for displaying the tool–specific functions can be hidden via settings of the respective machine data. If both M commands of a function =–1, the corresponding field is not displayed on the interface.

Special properties in "MANUAL" mode

In "MANUAL" mode, no spindle direction of rotation, coolant and tool–specific functions are output to the ShopMill interface. 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 ShopMill on NCU (HMI Embedded sl)

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 texts of the tool–specific functions can be changed in the text file ALUC.TXT. For this purpose, select the texts in the directory /siemens/sinumerik/cycles/lng/deu you want to change and save the text files edited in the editor in the directory
– /oem/sinumerik/cycles/lng/deu or
– /user/sinumerik/cycles/lng/deu
.

Text numbers

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

Table 8-3 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.

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.

More detailed information can be found in the following documentation:

References: /IHE/, Commissioning Base Software and HMI Embedded sl, SINUMERIK 840D sl

8.9.2 PCU 50.3

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. The file ALUC_xx.COM may have to be created in the directory CUS.DIR.
In the file F:\USER\MBDDE.INI, add the following line in the section [TextFiles]:
`UserZYK=F:\dh\cus.dir\aluc_`

Text numbers

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

Table 8-4 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

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 8-5 Language assignment

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

In the file F:\USER\MBDDE.INI, add the following line in the section [TextFiles]:

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

More detailed information can be found in the following documentation:
References::

/IHA/,Commissioning Base Software and HMI Advanced,
Operator Interface Extension,
SINUMERIK 840D sl/840D/840Di

8.10 Configuring the operator interface

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

- In tool management, in addition to the tools, wear, and magazine lists, an additional list can also be activated on the 3rd horizontal softkey; (see section 8.10.1 ”Integrating additional list”).
- Dependent upon the tool, you can configure the existing or user–defined parameters in the lists (see chapter 8.10.2 ”Configuring lists”).

8.10.1 Integrating additional list

If you want to activate an additional list or change the lists, proceed as follows:

- Setting machine data
  9478 $MM_TO_OPTION_MASK, bit 2=1
  Activate additional list

  You can now call up a list with the following parameters in the tool management using the 3rd horizontal softkey:
  – ”LROU”
  – ”Location type”

- Specifying texts for additional list (optional)
  If you want to change the softkey label (OEM tool list) and header (OEM tool list) of the additional list, you must define new texts (see chapter 8.10.7 ”Defining texts”).

8.10.2 Configuring lists

To modify existing lists (including an integrated additional list) you must proceed as follows:

Activate the configuration file

Set the following machine data:

MD 9478 $MM_TO_OPTION_MASK, bit 8
Analyze the file TO_MILL.INI

The configuration file TO_MILL.INI, in which you configure changes from the standard settings, is analyzed (see chapter 8.10.3 ”Creating the configuration file”).

Activate use of OEM data

If you use user–defined OEM data, 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 user–defined parameters

MD 18095 $MN_MM_TYPE_CC_TDA_PARAM[n]=4
Data type (REAL) of user–defined parameters

MD 20310 $MC_TOOL_MANAGEMENT_MASK, Bit 2
Activate user functions

Texts for user–defined parameters (optional)
If you want to change the column headers and cursor texts of the user–defined parameters, define new texts (see chapter 8.10.7 ”Defining texts”).

Adapt the configuration file

Define all changes from the standard settings in the configuration file TO_Mill.INI (see chapter 8.10.3 ”Creating the configuration file”).

8.10.3 Creating the 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:

- After the column ”DP number” you can define further columns and also hide existing columns.
- The number of columns displayed is limited by the width of the window because each column has a fixed width. Horizontal scrolling is not possible.
- Per column define cutting edge parameters only, tool parameters only, or magazine parameters only.
- Define the cutting edge parameters in consecutive columns.

The sample file TO_MILL.INI, which can be adapted, is located in ShopMill on NCU (HMI Embedded sl) under CYCLE_STORAGE\SEQUENCER_CYCLES\TEMPLATES_DEU.
The adapted file is then found on the CF card (NCU 7x0) under
– oem\sinumerik\hmi\cfg\
– user\sinumerik\hmi\cfg\.

For ShopMill on PCU 50.3, this example is located on the supplied CD under Tools\TEMPLATES_DEU.
The file is copied to the directory OEM or USER.

Syntax

Entries in the configuration file are subject to the following syntax rules; (see also example at end of this section):

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, 1 – 12
  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 forward slash.

  If, for example, you only want to modify the last few 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_IDENTIFIER / ..`

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 mark comments by means of 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. For the ShopMill on NCU (HMI Embedded sl) version, the file is located on drive I:, for PCU 50.3 in the directory F:\MMC0W32\TMP.

Identifier

The following tables list the SCREEN_ IDENTIFIERS, TOOL_ IDENTIFIERS, and CONTENTS_ IDENTIFIERS available for defining the columns.

Table 8-6 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
TOOL_LIST_OEM_2ND_EDGE	Further cutting edges

Table 8-7 TOOL_IDENTIFIER

TOOL_IDENTIFIER	Tool
SHANK_END_CUTTER	(End) cutter
POINTED_DRILL	(Twist) drill
TO_SCREW_TAP	Screw tap
END_MILL_CUTTER	Facing tool
ANGLE_HEAD_CUTTER	Angle head mill
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	Bevel cutter
3DCUTTER_156	Bevel cutter with corner rounding
3DCUTTER_157	Tapered die–sinking cutter

Table 8-8 CONTENT_ID

CONTENT_ID	Parameter type *	Parameter or property	Field width in number of characters
EMPTY		Empty field	
NOT_USED		Empty column	
LENGTH	S	Length	7
RADIUS	S	Radius	7
RADIUS_ DIAM	S	Radius with possible diameter calculation	7
ANGLE	S	Angle	5
N	S	Number of teeth	2
SPINDLE	S	Spindle direction	1
COOL1	S	Cooling water 1	1
COOL2	S	Cooling water 2	1
MFCT1	S	Tool–specific function 1	1
MFCT2	S	Tool–specific function 2	1
MFCT3	S	Tool–specific function 3	1
MFCT4	S	Tool–specific function 4	1
DLENGTH	S	Wear length	7
DRADIUS	S	Wear radius	6
DRADIUS_ DIAM	S	Wear radius with possible diameter calculation	6
T_OR_C	W	Method of wear monitoring	1
P_TIME	S	Tool life	7

Table 8-8 CONTENT_ID

CONTENT_ID	Parameter type *	Parameter or property	Field width in number of characters
PW_TIME	S	Tool life warning limit	7
P_COUNT	S	Quantity	7
PW_COUNT	S	Pre–warning limit for count	7
P_WEAR	S	Wear	7
PW_WEAR	S	Prewarning limit for wear	7
T_LOCKED	W	Tool disabled	1
T_SIZE	W	Oversized tool	1
T_FIXED	W	Tool in fixed location	1
T_STATE	W	Status code: Active/prewarning limit reached/blocked	5
T_MAG_ PLACE_TYPE	W	Magazine location type The parameter is not contained in the standard tool list of ShopMill. Column header: Location type Cursor text: Magazine location type Input: Number of magazine location type Entry requirement: The tool must be located outside a magazine.	5
P_LOCKED	M	Magazine location locked	6
MAG_T_ LOCKED	W	Display only: Tool disabled	1
MAG_T_SIZE	W	Display only: Oversized tool	1
MAG_T_ FIXED	W	Display only: Tool in fixed location	1
H_NBR	S	H number of an ISO dialect program	3
TPC1	W	Parameter 1	7
TPC2	W	Parameter 2	7
TPC3	W	Parameter 3	7
TPC4	W	Parameter 4	7
TPC5	W	Parameter 5	7
TPC6	W	Parameter 6	7
TPC7	W	Parameter 7	7
TPC8	W	Parameter 8	7
TPC9	W	Parameter 9	7
TPC10	W	Parameter 10	7

* Parameter types: S = cutting edge data, W = tool data, M = magazine data.

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
```

8.10.4 Adapting individual parameters

Using the configuration file to_mill.ini, you can change the default settings for specific tool parameters.

Table 8-9 PARAMETER_IDENTIFIER

PARAMETER_IDENTIFIER	Parameter
T_MAG_PLACE_TYPE	Magazine location type
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
TPC10	Parameter 10

Magazine location type

You can change the input field into a toggle field for the parameter ”Magazine location type”. The following values are entered: You must define the values of the toggle field in the section T_MAG_PLACE_TYPE, by assigning values to cursor texts.

Value = Text ID

Valid text IDs and information on defining texts are provided in Chapter 8.10.7 ”Defining texts”).

Example

```
[T_MAG_PLACE_TYPE]
DEFAULT = 89891
1 = 89868
2 = 89869
5 = 89872
9 = 89876
```

In this example, in the column ”location type” you can select the values 1, 2, 5 or 9 using the ”alternative” softkeys. Here, the values have been randomly selected. Cursor texts that have been saved are displayed for the selected values. If the actual value of the parameter devices from the configured values, then the text, saved as DEFAULT, is displayed as cursor text.

OEM parameter

You can change the input fields into toggle fields for the OEM tool parameters. In so doing, specific values are entered.
You must define the values of the toggle field in Sections TPC1 ... TPC10, by assigning cursor texts to the values (refer to Chapter 8.10.7 ”Defining texts”). Also refer to the example on ”Magazine location type” parameters.

You can define the width of the toggle field or the input field to a specific number of characters. The standard width is 7 characters.

Further, for the input field, you can also specify the data type (integer or double), however, only if you have not specified a toggle field. If you do not change the data type, then, the double data type set as default, is used.

Example

```
[TPC1]
WIDTH = 2
TYPE = INTEGER
```

In this example, the input fields of the column OEM tool parameter 1 are 2 characters wide. You can only enter integer values in the input fields.

8.10.5 Defining texts for the magazine locations on the intermediate buffer

The magazine locations of the buffer are shown, as standard using symbols in the tool manager lists. You can
assign texts to the location using the configuration file to_mill.ini.

ID for the buffer:
BUFFER

In the section BUFFER, the magazine locations of the buffer are assigned texts.

Magazine location = Text ID

Valid text IDs and information on defining texts are provided in Chapter 8.10.7 ”Defining texts”).

Example

```
[BUFFER]
DEFAULT = 89768
1 = 89790
2 = 89791
3 = 89792
```

In this example, three magazine locations of the buffer (spindle, gripper 1 and gripper 2) are assigned texts for the display in the tool manager lists. A default text is displayed for additional magazine locations of the buffer.

8.10.6 Designating a load magazine in the tool list sorted according to magazines

If the tool list is sorted according to magazines, all of the magazine locations are displayed in an increasing sequence according to magazine location and magazine number. Using the configuration time to_mill.ini, a magazine can be highlighted as load magazine by sorting this magazine so that it is directly located after the magazine locations of the buffer.

ID for the load magazine:
OEM_LOAD_MAGAZINE

Example

```
[OEM_LOAD_MAGAZINE]
MAGAZINE = 3
```

In this example, magazine 3 is configured as load magazine,. The magazine locations of magazine 3 are displayed directly after the magazine locations of the buffer in the tool list sorted according to magazine locations.

8.10.7 Define texts

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

These are subject to the following syntax:
`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 column header in the parameter name can consist of three lines, each line with its own text number; (see Table 8-10).

Table 8-10 Text assignment

Text type	Text number
3rd 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: 6
List header: 20
Column header parameter: 7 (dependent on the column width)
Cursor text parameters: 45

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

Note

Some texts for the parameters TPC1 and TPC2 are already prefilled with sample texts which can be changed.

Magazine location type, OEM parameter, magazine locations of the buffer

The texts for the magazine locations of the buffer and the cursor texts for the parameter, magazine location type and OEM parameter must be located as toggle field in the number range 89700 to 89899.

ShopMill on NCU (HMI Embedded sl)

For ShopMill on NCU (HMI Embedded sl), enter the texts and numbers in the text file ALUC.TXT. There is an ALUC.TXT text file in each language directory.

PCU 50.3

With the PCU 50.3 enter the texts and numbers in the text file F:\DH\CUS.DIR\ALUC_xx.COM. 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 text file name. In the text file name ”xx” is replaced by one of the following codes:

Table 8-11 Language assignment

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

Table 8-11 Language assignment

Abbreviation XX	Language
cz	Czech
ja	Japanese

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

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

8.11 Reading in tool data

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

Save the tool data as an INI file.

The header in the file must be exactly as follows:

```
;TOOL MAGAZIN ZEROPOINT,TOOL=2,MAGAZIN=0,NPV=0,BNPV=0
```

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

Tool=1:	Delete all existing tools in tool management and replace with new tools.
Tool=2:	Add new tools to tool management
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 on opening will be evaluated as a G code program. Starting the program with ”Cycle start” causes existing data in tool management to be overwritten by the data contained in the program.

The tool data must be assigned the following variables in the INI file, where:
x = tool number
y = cutting edge number

Table 8-12 Variable assignment

Variable	Description	Value
$TC_TP1[x]	Duplo number	Number
$TC_TP2[x]	Tool name	Name
$TC_TP3[x]	Number of adjacent half locations on 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 adjacent half locations on 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 adjacent half locations above to be blocked for oversized tools.	ShopMill default setting 1 = Do not disable adjacent location
$TC_TP6[x]	Number of adjacent 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	Description	Value
$TC_TP8[x]	Tool status	Bit 1 = 1: Tool enabled Bit 2 = 1: Tool disabled Bit 4 = 1: Prewarning limit reached Bit 6 = 1: Tool fixed–location–coded
$TC_TP9[x]	Tool monitoring	Bit 0 = 1: Tool life monitoring active Bit 1 = 1: Workpiece count monitoring active Bit 2 = 1: Wear monitoring active
$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 mill 140: Facing tool 155: Bevel cutter 156: Bevel cutter with corner rounding 157: Tapered die–sinking cutter 200: Twist drill 220: Centering tool 240: Tap 710: 3D probe 711: Edge probe
$TC_DP3[x,y]	Length or Length Z	Number [mm] Number [mm]
$TC_DP4[x,y]	Length 2 or Length Y	Number [mm] Number [mm]
$TC_DP5[x,y]	Length 3 or Length X	Number [mm] 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 or Wear length Z	Number [mm] Number [mm]

Table 8-12 Variable assignment

Variable	Description	Value
$TC_DP13[x,y]	Wear length 2 or Wear length Y	Number [mm] Number [mm]
$TC_DP14[x,y]	Wear length 3 or Wear length X	Number [mm] Number [mm]
$TC_DP15[x,y]	Wear radius	Number [mm]
$TC_DP21[x,y]	Basis length 1 or Basis length Z	Number [mm] Number [mm]
$TC_DP22[x,y]	Basis length 2 or Basis length Y	Number [mm] Number [mm]
$TC_DP23[x,y]	Basis length 3 or Basis length X	Number [mm] Number [mm]
$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 rotates clockwise Bit 9 = 1: Spindle rotates counter–clockwise 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_DPV[x,y]	Tool orientation +X, –X, +Y, –Y, +Z, –Z	
$TC_DPV3[x,y]	Tool orientation vector 1 or Tool orientation vector Z	Number Number
$TC_DPV4[x,y]	Tool orientation vector 2 or Tool orientation vector Y	Number Number
$TC_DPV5[x,y]	Tool orientation vector 3 or Tool orientation vector X	Number Number
$TC_MOP1[x,y]	Tool life warning limit	Number [min]
$TC_MOP2[x,y]	Tool life	Number [min]
$TC_MOP3[x,y]	Pre–warning limit for count	Number
$TC_MOP4[x,y]	Quantity	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

For bit–coded parameters you must specify a hexadecimal value.

The H number for ISO dialect programs is only analyzed if ShopMill is configured for ISO dialects (see chapter 11.2 ”ISO dialects”).

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

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

Notes about loading the tool data into the tool management can be found in:
References: /BASsl/, Operating/Programming ShopMill

Example

```
;TOOL MAGAZIN ZEROPOINT,TOOL=2,MAGAZIN=0,NPV=0,BNPV=0
$TC_TP1[1]=1                ;Duplo number
$TC_TP2[1]=FRAESER          ;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
```

■

Space for your notes

Additional Functions

9

9.1 Measuring cycles

9.1.1 Product brief

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.

References:

/FB2/, Function Manual on Expansion Functions, Measuring (M5);
/GDsl/, Device Manual NCU, SINUMERIK 840D sl
/IDsl/, Commissioning CNC: NCK, PLC, drive, SINUMERIK 840D sl

Measuring cycles

The measuring cycles are supplied with ShopMill.

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

Function test

The measuring probe operates internally with the command MEAS.
The functional test of the measuring probe is carried out by a part program.

References: /PGA/, Programming Manual on Production Planning;
/BNM/, Programming Manual on Measuring Cycles

9.1.2 Display machine data measuring cycles

9747 MD number	CMM_ENABLE_MEAS_AUTO Enable automatic workpiece measurement		
Default setting: 1	Min. input limit: 0	Max. input limit: 1	
Changes effective as from NOW	Protection level: 3/4	Units: –	
Data type: BYTE	Valid as of software version: ShopMill 6.4		
Significance:	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	Min. input limit: 0	Max. input limit: 1	
Changes effective as from NOW	Protection level: 3/4	Units: –	
Data type: WORD	Valid as of software version: ShopMill 6.3		
Significance:	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	Min. input limit: 0	Max. input limit: 1	
Changes effective as from NOW	Protection level: 3/4	Units: –	
Data type: BOOL	Valid as of software version: ShopMill 4.3		
Significance:	This MD defines the measuring input for a workpiece measuring probe. 0 = measuring input 1 is activated 1 = measuring input 2 is activated		

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

9752 MD number	CMM_MEASURING_DISTANCE Max. measurement distance for workpiece measurement in the program		
Default setting: 5	Min. input limit: 0.01	Max. input limit: 1000	
Changes effective as from NOW	Protection level: 3/4	Units: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Significance:	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 this 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	Min. input limit: 0.01	Max. input limit: 1000	
Changes effective as from NOW	Protection level: 3/4	Units: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Significance:	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 this range the error message ”Probe does not switch” is output.		

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

9755 MD number	CMM_MEAS_DIST_TOOL_RADIUS Max. measurement distance for tool radius for rotating. Spindle		
Default setting: 1	Min. input limit: 0.001	Max. input limit: 1000	
Changes effective as from NOW	Protection level: 3/4	Units: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Significance:	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 this 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	Min. input limit: 10	Max. input limit: 5000	
Changes effective as from NOW	Protection level: 3/4	Units: mm/min	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Significance:	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	Min. input limit: 10	Max. input limit: 5000	
Changes effective as from NOW	Protection level: 3/4	Units: mm/min	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Significance:	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	Min. input limit: 10	Max. input limit: 5000	
Changes effective as from NOW	Protection level: 3/4	Units: mm/min	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Significance:	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 Maximum circumferential speed for tool measurement for rotating Spindle		
Default setting: 100	Min. input limit: 1	Max. input limit: 200	
Changes effective as from NOW	Protection level: 3/4	Units: m/min	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Significance:	This MD is used to stipulate the maximum permissible circumferential speed of the tools to be measured for tool measurement with rotating spindle. The permissible spindle speed for carrying out tool measurement is calculated according to this MD.		

9760 MD number	CMM_MAX_SPIND_SPEED_ROT_SP Maximum speed for tool measurement for rotating Spindle		
Default setting: 1000	Min. input limit: 100	Max. input limit: 25000	
Changes effective as from NOW	Protection level: 3/4	Units: rev/min	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Significance:	This MD is used to stipulate the maximum permissible rotational 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	Min. input limit: 0.01	Max. input limit: 1000	
Changes effective as from NOW	Protection level: 3/4	Units: mm/min	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Significance:	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	Min. input limit: 0	Max. input limit: 1	
Changes effective as from NOW	Protection level: 3/4	Units: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Significance:	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	Min. input limit: 0	Max. input limit: 999	
Changes effective as from NOW	Protection level: 3/4	Units: –	
Data type: WORD	Valid as of software version: ShopMill 4.3		
Significance:	This MD is used to define the type of tool measuring probe. 0 = measuring cube 101 = zero disk in XY (1st and 2nd geometry axis) 201 = zero disk in ZX (3rd and 1st geometry axis) 301 = zero 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	Min. input limit: 0	Max. input limit: 333	
Changes effective as from NOW	Protection level: 3/4	Units: –	
Data type: WORD	Valid as of software version: ShopMill 4.3		
Significance:	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 tool probe length measurement		
Default setting: 0	Min. input limit: 0	Max. input limit: 100000	
Changes effective as from NOW	Protection level: 3/4	Units: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Significance:	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 tool probe radius measurement		
Default setting: 0	Min. input limit: 0	Max. input limit: 100000	
Changes effective as from NOW	Protection level: 3/4	Units: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Significance:	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	Min. input limit: 0	Max. input limit: 100000	
Changes effective as from NOW	Protection level: 3/4	Units: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 4.3		
Significance:	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	Min. input limit: –2	Max. input limit: 2	
Changes effective as from NOW	Protection level: 3/4	Units: –	
Data type: BYTE	Valid as of software version: ShopMill 4.3		
Significance:	This MD is used to specify the approach direction on the plane on which the tool approaches the tool measuring probe. –1 = 1st plane axis in negative direction +1 = 1st plane axis in positive direction –2 = 2nd plane axis in negative direction +2 = 2nd plane axis in positive direction		

9769 MD number	CMM_FEED_FACTOR_1_ROT_SP Feed rate factor 1 tool measurement for rotating. sp.		
Default setting: 10	Min. input limit: 0	Max. input limit: 100	
Changes effective as from NOW	Protection level: 3/4	Units: –	
Data type: DOUBLE	Valid as of software version: ShopMill 6.3		
Significance:	This MD specifies the feed factor for the 1st measuring operation for tool measurement with rotating spindle. 0: Only one measurement is taken >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	Min. input limit: 0	Max. input limit: 50	
Changes effective as from NOW	Protection level: 3/4	Units: –	
Data type: DOUBLE	Valid as of software version: ShopMill 6.3		
Significance:	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. The feed factor should be less than the feed factor in MD 9769 CMM_FEED_FACTOR_1_ROT_SP. 0: Only two measurements are taken >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 Maximum feed for tool measurement for rotating Spindle		
Default setting: 20	Min. input limit: 1	Max. input limit: 1000	
Changes effective as from NOW	Protection level: 3/4	Units: mm/min	
Data type: DOUBLE	Valid as of software version: ShopMill 6.3		
Significance:	This MD defines the maximum feed rate for tool measurement with a rotating spindle.		

9772 MD number	CMM_T_PROBE_MEASURING_DIST Measurement distance for tool measurement with stationary spindle		
Default setting: 5	Min. input limit: 1	Max. input limit: 1000	
Changes effective as from NOW	Protection level: 3/4	Units: mm	
Data type: DOUBLE	Valid as of software version: ShopMill 6.3		
Significance:	This MD is used to stipulate the measurement distance for tool measurement with stationary spindle and during probe calibration.		

9773 MD number	CMM_T_PROBE_MEASURING_FEED Feed rate for tool measurement with stationary spindle		
Default setting: 300	Min. input limit: 10	Max. input limit: 5000	
Changes effective as from NOW	Protection level: 3/4	Units: mm/min	
Data type: DOUBLE	Valid as of software version: ShopMill 6.3		
Significance:	This MD is used to stipulate the feed for tool measurement with stationary spindle and during probe calibration.		

9774 MD number	CMM_T_PROBE_MANUFACTURER Tool probe type (manufacturer)		
Default setting: 0	Min. input limit: 0	Max. input limit: 2	
Changes effective as from NOW	Protection level: 3/4	Units: –	
Data type: WORD	Valid as of software version: ShopMill 6.3		
Significance:	This MD defines the tool measuring probe type so that predefined offset tables of some tool measuring probe models can be used for tool measurement with rotating spindle. 0 = no data 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	Min. input limit: 0	Max. input limit: 2	
Changes effective as from NOW	Protection level: 3/4	Units: –	
Data type: WORD	Valid as of software version: ShopMill 6.3		
Significance:	With this MD, you can activate a measuring result correction. Such an offset may be necessary if the tool measuring probe switches differently for different rotational speeds of the tool to be measured. 0 = no offset 1 = offset by means of predefined offset tables (for TT130 Heidenhain or TS27R Renishaw) 2 = offset via user–defined offset tables (see /BNM/, User's Guide Measuring Cycles, _MT_EC_R[ ] and _MT_EC_L[ ]) (The user–defined offset is also carried out if MD 9774 CMM_T_PROBE_MANUFACTURER = 1 or 2)		

9776 MD number	CMM_MEAS_SETTINGS Settings for measuring cycles		
Default setting: 0	Min. input limit: –	Max. input limit: –	
Changes effective as from NOW	Protection level: 3/4	Units: –	
Data type: WORD	Valid as of software version: ShopMill 6.3		
Significance:	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 results automatically from the rotation of the workpiece coordinate system about the tool axis so that the same point always points to the measuring probe ball 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. Bit 1 = 0: Calibration of the workpiece probe in a boring with unknown center. Bit 1 = 1: Calibration of the workpiece probe in a boring with known center. For this, the measuring probe must be positioned in the center.		

9778 MD number	CMM_MEAS_PROBE_SOUTH_POLE Measuring probe length referenced to lower edge		
Default setting: 1	Min. input limit: 0	Max. input limit: 1	
Changes effective as from NOW	Protection level: 3/4	Units: –	
Data type: BYTE	Valid as of software version: ShopMill 6.4		
Significance:	This machine data defines the reference point for the workpiece measuring probe length. 0: The ball center is defined as reference point. 1: The lower edge of the ball (south pole) is defined as reference point.		

9779 MD number	CMM_MEAS_PROBE_IS_MONO Workpiece measuring probe is mono probe		
Default setting: 0	Min. input limit: 0	Max. input limit: 1	
Changes effective as from NOW	Protection level: 3/4	Units: –	
Data type: BYTE	Valid as of software version: ShopMill 7.1		
Significance:	This machine data defines the workpiece measuring probe as mono probe. A mono probe can be turned to an angle using SPOS. It is positioned so that it always uses the same edge at the workpiece for measurements. 0: Workpiece measuring probe is not a mono probe 1: Workpiece measuring probe is mono probe		

9.2 Network link

9.2.1 General description

Option

The function "Managing network drives" is an option with Order No. 6FC5 800–0AP01–0YB0.

For installing the network, please refer to

References: /IHE/, Commissioning Base Software and HMI Embedded sl, SINUMERIK 840D sl;
/IHA/, Commissioning Base Software and HMI Advanced, SINUMERIK 840D sl/840D/840Di

9.3 Cylinder surface transformation

9.3.1 Function

Option

The function ”Cylinder surface transformation” can only be used if the function ”Tracyl” (option) is used in the standard.
The Order No. is: 6FC5 800–0AM27–0YB0.

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)

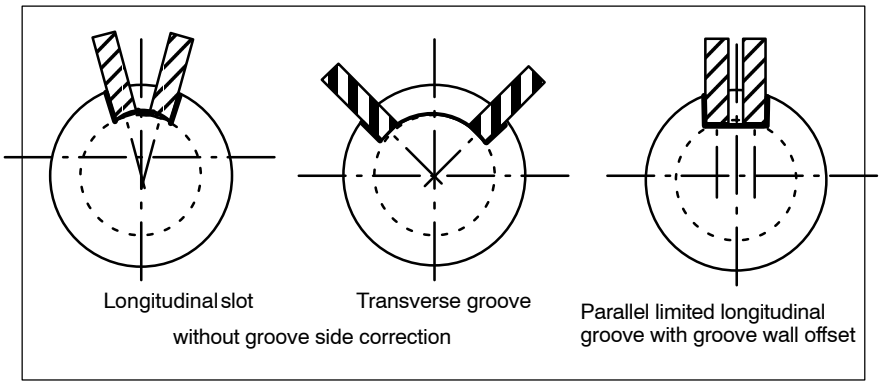


Fig. 9-1 Grooves with and without groove wall offset

Enable cylinder surface transformation

The function ”Cylinder surface transformation” is displayed on the ShopMill operator interface if the display MD 9721 $MM_CMM_ENABLE_ TRACYL=1 is used. 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.

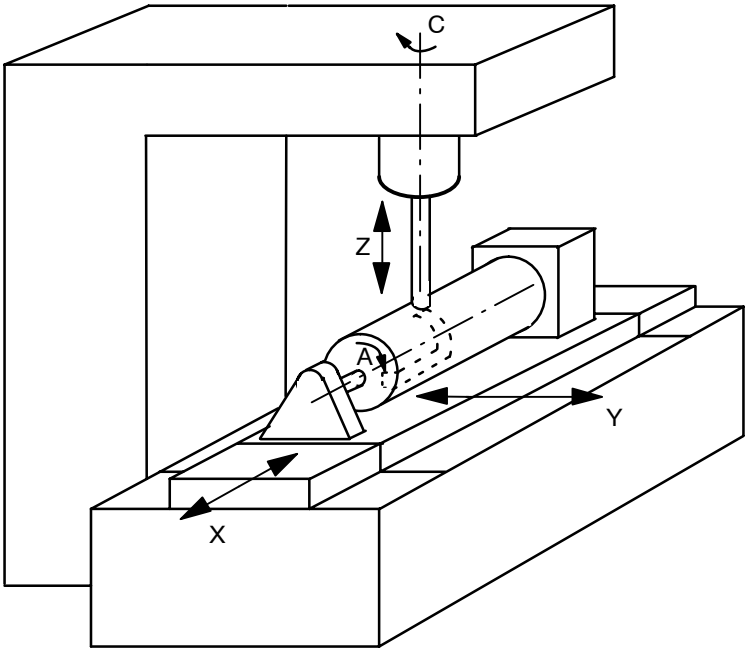
The cylinder surface transformation function is selected and deselected via ”Miscellaneous”, ”Transformations”, ”Cylinder surface” softkey on the ShopMill Operator interface and is described in:

References: /BASsl/, 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. 9-2 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

Data block for the 1st transformation in the channel:
24100 $MC_TRAFO_TYPE_1=**512**
Transformer type(512 = Cylinder surface transformation without groove side compensation)
24110 $MC_TRAFO_AXES_IN_1[0]=3
Channel axis: Feed axis vertical to rotary axis (Z)
24110 $MC_TRAFO_AXES_IN_1[1]=4
Channel axis: Rotary axis (A)
24110 $MC_TRAFO_AXES_IN_1[2]=1
Channel axis: Axis parallel to rotary axis (X)
24110 $MC_TRAFO_AXES_IN_1[3]=2
Channel axis: Supplementary axis (Y)
24120 $MC_TRAFO_GEOAX_ASSIGN_TAB_1[0]=1
Channel axis: 1. Geometry axis (X)
24120 $MC_TRAFO_GEOAX_ASSIGN_TAB_1[1]=4
Channel axis: 2. Geometry axis (A)
24120 $MC_TRAFO_GEOAX_ASSIGN_TAB_1[2]=3
Channel axis: 3. Geometry axis (Z)
24800 $MC_TRACYL_ROT_AX_OFFSET_1=0
Offset of the rotary axis for the 1st TRACYL transformation
24805 $MC_TRACYL_ROT_AX_FRAME_1=1
Axial offset of the rotary axis for the 1st TRACYL transformation
24810 $MC_TRACYL_ROT_SIGN_IS_PLUS_1=1
Sign for 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

Data block for the 2nd transformation in the channel:
24200 $MC_TRAFO_TYPE_2=**513**
Transformer type (513 = Cylinder surface transformer with groove side compensation)
24210 $MC_TRAFO_AXES_IN_2[0]=3
Channel axis: Feed axis vertical to rotary axis (Z)
24210 $MC_TRAFO_AXES_IN_2[1]=4
Channel axis: Rotary axis (A)
24210 $MC_TRAFO_AXES_IN_2[2]=1
Channel axis: Axis parallel to rotary axis (X)
24210 $MC_TRAFO_AXES_IN_2[3]=2
Channel axis: Supplementary axis (Y)
24220 $MC_TRAFO_GEOAX_ASSIGN_TAB_2[0]=1
Channel axis: 1. Geometry axis (X)
24220 $MC_TRAFO_GEOAX_ASSIGN_TAB_2[1]=4
Channel axis: 2. Geometry axis (A)
24220 $MC_TRAFO_GEOAX_ASSIGN_TAB_2[2]=3
Channel axis: 3. Geometry axis (Z)
24850 $MC_TRACYL_ROT_AX_OFFSET_2=0
Offset of the rotary axis for the 2nd TRACYL transformation
24855 $MC_TRACYL_ROT_AX_FRAME_2=1
Axial offset for the 2nd TRACYL transformation
24860 $MC_TRACYL_ROT_SIGN_IS_PLUS_2=1
Sign for 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 used to create or process slanted planes.

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

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

You can define swivel data sets using the ”Swivel cycle” softkey in the ”Commissioning” 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 commissioning process (defining swivel data records and adapting swivel cycle TOOLCARR) can be found in:
References: /PGZ/, Programming Manual on Cycles

Interrupts

During the manual setting of the swivel head/table, alarms are issued that indicate the required angles:
62180 manually setting both axes
62181 manually setting one axis

With a Hirth tooth system, the corresponding rotary axes can only assume certain positions (angle grid > 0). If the programming requires a position that deviates from the angle grid, the machine automatically sets the adjacent position and issues an alarm.
112328 Angle adapted to angle grid
The swivel cycle TOOLCARR allows for defining how the alarm must be acknowledged.

If the processing of the workpiece requires an angle of the swivel head/table that falls outside the valid angle area, an alarm is issued:
61184 No solution possible with current angle values
The programmed processing cannot be performed using the existing swivel head/table.

For manual loading/unloading or replacing of swivel heads, ShopMill issues one of the following alarms:
112323 Unload swivel head
112324 Load swivel head
112325 Replace swivel head
In addition, the swivel cycle TOOLCARR is called for loading/unloading or replacing 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 process the same program multiple times on the clampings or you can select different programs.
The function ”Multiple clamping with different programs” is a software option with the Order No. 6FC5 800–0AP14–0YB0.

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 cycle CLAMP.SPF which is stored in the directory CYCLES\SC\PROG\TEMPLATES_DEU or \TEMPLATES_ENG.
- Copy the cycle into the user or manufacturer cycles directory.

Example

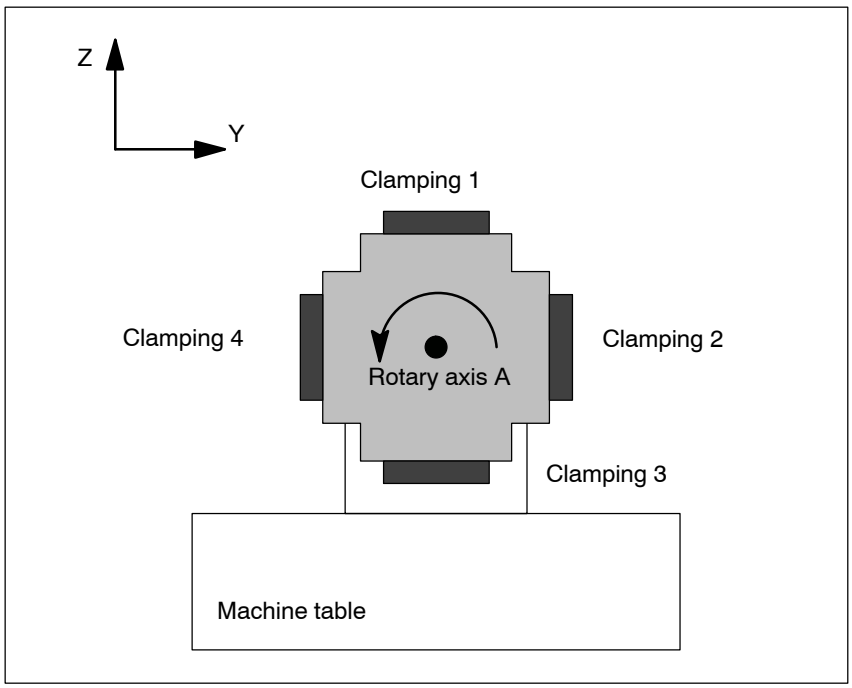


Fig. 9-3 Rotating clamping device (reversible clamping device)

In the example, a rotating clamping device (reversible clamping device) is used with 4 clampings. The clampings can be processed by positioning rotary axis A.

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 800–0AP28–0YB0.

For more information on measuring cycle support please refer to:

References: /BNM/, Programming Manual on Measuring Cycles

For commissioning, proceed as follows:

ShopMill on NCU (HMI Embedded sl)

- Remove the semicolon ”;” preceding the following line in the file STANDARD_CYCLES\COMMON.COM:
  ```
  ;sc8407=aeditor.com     ;Milling measuring cycles (horizontal softkey 7
                          ;on the expanded softkey bar in the
                          ;G–code editor)
  ```
  This creates the link between the softkey, with which you call the measuring cycle support, and the configuration file of this support mask.
- Remove the semicolon ”;” preceding the following line in file STANDARD_CYCLES\COMMON.COM:
  ```
  ;sc617=startup.com      ;Commissioning operating area (horizontal
                          ;softkey 7 on the expanded softkey bar)
  ```
  You can modify the characteristics of the measuring cycle support in the commissioning operating area.
- Restart the machine.
- If required, modify the characteristics for the measuring cycle support in the ”Commissioning” → ”>” → ”Measuring cycles” menu.

PCU 50.3

Prerequisite:
During commissioning of HMI Advanced, the files AEDITOR.COM and STARTUP.COM were automatically created in the STANDARD_CYCLES directory (CST.DIR).
During commissioning of ShopMill, the archive SM_CYC.ARC was loaded from the PCU 50.3 into the NC. The COMMON.COM file was automatically copied to the STANDARD_CYCLES directory (CST.DIR).

- Copy the archive MCSUPP from the ARCHIVES\CYCLE_ARCHIVES\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 the file SIEMENSD.RTF or SIEMENSE.RTF on the software CD) deviate from the measuring cycles of HMI Advanced (see ARCHIVES\CYCLE_ARCHIVES\MCYC\VERSION.ARC) in the first four digits (e.g. 06.02), you must import the archive MCYCMILL from the directory ARCHIVES\CYCLE_ARCHIVES\MCYC.

- In the file STANDARD_CYCLES\COMMON.COM, remove the semicolon ";" preceding the following line:

```
;sc8407=aeditor.com     ;Milling measuring cycles (horizontal softkey 7
                        ;on the expanded softkey bar in the
                        ;G–code editor)
```

  In the file STANDARD_CYCLES\AEDITOR.COM, remove the semicolon ";" preceding the following lines:

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

  This creates the link between the softkey, with which you call the measuring cycle support, and the configuration file of this support mask.

- 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 Commissioning operating area.

- Restart the PCU 50.3.

- If required, modify the characteristics for the measuring cycle support in the "Commissioning" → ">" → "Measuring cycles" menu.

■

Customer–Specific Operator Interface 10

10.1 Configuring the customized boot screen

For the ShopMill variant with PCU 50.3, you can create your own customer image (company logo, etc.) which appears while loading the control. For this purpose, you create an image in 256–color mode. The maximum size of the image is 224x224 pixels for OP010/OP010C/OP010S/OP012 and 352x352 pixels for OP015 352x352.

Details on how to proceed during configuration and when exchanging the startup image can be found in:

References:

/IHA/, Commissioning Base Software and HMI Advanced, SINUMERIK 840D sl/840D/840Di

10.2 Configuring the custom screen

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

References: /IAM/, Commissioning Base Software and HMI Advanced, Operator Interface Extension, SINUMERIK 840D sl/840D/840Di;
/IHE/, Commissioning Base Software and HMI Embedded sl, Operator Interface Extension, SINUMERIK 840D sl

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 main parts of the screen are fixed according to the operating area and mode. This only applies for screens that can be accessed via entry softkeys.

Table 10-1 Specified dimensions of the forms in ShopMill

Exit screen	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
Operating Area Program – Drilling/Milling	Vertical softkey 6		X–pos. = 33 Y–pos. = 52 height = 378 pixels width = 523 pixels

Table 10-1 Specified dimensions of the forms in ShopMill

Exit screen	Softkey	Size	Dimensions
Program operating area – Miscellaneous	Vertical softkey 4		X–pos. = 33 Y–pos. = 52 height = 378 pixels width = 523 pixels
Operating Area Program – 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 8		X–pos. = 0 Y–pos. = 34 height = 396 pixels width = 556 pixels
Operating area – Tools/ Zero offsets	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 customized 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.
In manual and automatic modes you have the choice between different sized screens 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 screens

Exit screen	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
Operating area – Tools/ Zero offsets	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 screens you configured yourself.

Note

Open a user–configured screen 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	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 your own 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	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

Table 10-4 Entry softkeys for measuring cycles

Exit screen	Softkey	SCxxxx
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
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. Note that the cycle must contain the function Generate Code (GC) and an OUTPUT method so that NC code is generated and sent to NCK for processing.

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 8

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 ShopMill 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.

Once–only machining

If an operating step should not be performed at all positions but, instead, only once, the user variable E_ONETIME = 1 must be set in the corresponding cycle. This allows for implementing modal changes for the subsequent technologies.

Application example:
Toggle between the parallel axes W and Z for a boring mill.

Example

The directory CYCLES\SC\PROG\TEMPLATES_DEU or CYCLES\SC\PROG\TEMPLATES_ENG 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. The VSK8 should therefore not be labeled.

Example

The directory CYCLES\SC\PROG\TEMPLATES_DEU or CYCLES\SC\PROG\TEMPLATES_ENG contains the archive file E_MS_O1.ARC which contains the sample measuring cycle E_MS_O1.SPF. The associated operator interface is configured in the E_DR_O1.COM file. The 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 Section 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 50.3)

For ShopMill Open, the HMI advanced operating areas ”Parameter” (without tool management and work offsets), ”Services”, ”Diagnostics” and ”Commissioning” are located on the expanded horizontal softkey bar.

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

In ShopMill Open you can also 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.
Refer to the ShopMill DVD for details.

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 jump

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: /IHA/, Commissioning Base Software and HMI Advanced, Operator Interface Extension, SINUMERIK 840D sl/840D/840Di;
/IHE/, Commissioning Base Software and HMI Embedded sl, Operator Interface Extension, SINUMERIK 840D sl;
keyword ”OP Hotkeys” and ”PLC Keys”

10.4 User status display

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

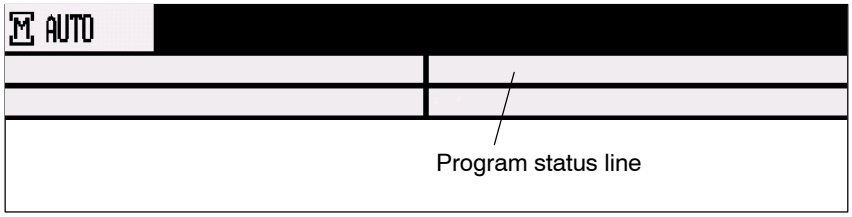


Fig. 10-1 Program status line

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 bar.

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 pixel (height x width)
- File name: 8 characters
- Format: BMP

For ShopMill on PCU 50.3 (HMI Advanced), you should store user symbols in the directory F:\DH\CUS.DIR\HLP.DIR.

For ShopMill on NCU (HMI Embedded sl), you should place the icons in the following folders:

Table 10-5 Directory for saving user–specific icons

Storage folder	OP/resolution	Size of icons (height x width)
ico640	OP 010 (640 x 480)	16 x 16 pixels
ico800	OP 012 (800 x 600)	20 x 20 pixels
ico1024	OP 015 (1024 x 768)	27 x 26 pixels

The user–specific icons are stored in folders (icoxxx) in the following three subdirectories:

- Manufacturer: \oem\sinumerik\hmi\ico/\coxxx
- User: \oem\sinumerik\hmi\ico\icoxxx

10.4.1 Configuring the user status display

The cross–channel status display is allocated and configured with user symbols in the HEADER.INI file.

ShopMill on PCU 50.3

The HEADER.INI file is located in the directory F:\HMI_ADV and must be copied either to the directory F:\OEM or F:\USER.

In the section `UserIcons` of the HEADER.INI file, enter the names of the user symbols and the signal for the control of the symbol selection.

Note

If you have already made these entries for HMI Advanced, you do not have to repeat the entries for ShopMill.

```
[User icons]
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.

References: /IHA/, Commissioning Base Software and HMI Advanced, SINUMERIK 840D sl/840D/840Di

ShopMill on NCU (HMI Embedded sl)

The CompactFlash card contains the HEADER.INI file in the directory siemens\sinumerik\hmi\cfg\

Copy the HEADER.INI file to the directory oem\sinumerik\hmi\cfg.
Open the file using the editor and assign the desired positions to the user symbols.

References: /IHE/, Commissioning Base Software and HMI Embedded sl, SINUMERIK 840D sl

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.

Configuration

You can switch to the following operating areas with the OP hotkeys or PLC keys:

- ShopMill on NCU (HMI Embedded sl)
  From ShopMill to any operating area of ShopMill.
- PCU 50.3
  From ShopMill to any other operating area in ShopMill.
  From ShopMill to any other operating area in HMI Advanced and vice versa.

Information about the configuration can be found in:

References: /IHA/, Commissioning Base Software and HMI Advanced, Operator Interface Extension, SINUMERIK 840D sl/840D/840Di;
/IHE/, Commissioning Base Software and HMI Embedded sl, SINUMERIK 840D sl;
keyword ”OP Hotkeys” and ”PLC Keys”

Note

The configuration of the ”PLC Keys” in ShopMill is carried out in the file KEYS.INI, not via DB 19 interface.
The file KEYS.INI must feature the following entry in the section [HMI_INI_FILES]:

```
Task6 = shopmill.ini
```

■

Miscellaneous

11

11.1 Access protection via password and keyswitch

11.1.1 General

Access rights

Access to programs, data and functions is protected on a user basis via 8 hierarchical protection levels. These are divided into (see table 11-1):

- 4 password levels for Siemens, machine manufacturer and end user
- 4 key switch positions for end user

This provides a multilevel safety concept for controlling access rights.

Table 11-1 Access protection

Protection level	Type	User	Access to (examples)
0	Pass–word	Siemens	All functions, programs, and data
1	Pass–word	Machine manufacturer: Development	Defined functions, programs and data; for example: Enter options
2	Pass–word	Machine manufacturer: Commissioning engineer	Defined functions, programs, and data; for example: Majority of machine data
3	Pass–word	End user: Service	Assigned functions, programs, and data
4	Key–switch Pos. 3	End user: Programmer machine setter	Lower than protection level 0 to 3; Defined by machine manufacturer or End user
5	Key–switch Pos. 2	End user: qualified user, who does not program	Lower than protection level 0 to 3; Defined by end user
6	Key–switch Pos. 1	End user: Trained user, who does not program	Example: Program selection only, Tool wear input and input of zero offset
7	Key–switch Pos. 0	End user: Semi–skilled operator	Example: No inputs or program selection possible, only machine control panel can be operated

Decreasing access rights

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

Setting the 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: /BEMsl/, Operating Manual HMI Embedded sl or
/BAD/, Operating Manual HMI Advanced

Resetting the 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 password levels 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 commissioning mode (NCK commissioning switch in position 1).

The default passwords should be changed in order to guarantee reliable access protection.

11.1.3 Keyswitch settings

Keyswitch

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 Section 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 setting	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	Bit6	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	Switch over between Inch/metric
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 fine tool wear and fine offsets
9206 USER_CLASS_WRITE_TOA_SUPVIS	Change limit values for tool monitoring
9210 USER_CLASS_WRITE_ZOA	Write rough offsets
9215 USER_CLASS_WRITE_SEA	Write setting data
9216 USER_CLASS_READ_PROGRAM (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
9254 USER_CLASS_TM_SKTOOLMOVE	Enable relocation of a tool
9258 USER_CLASS_TM_SKNCNEWTOOLE	Enable setting up of new cutting edges
9259 USER_CLASS_TM_SKNCDELTOOL	Enable deleting of a tool
9264 USER_CLASS_TM_SKTLNEWTOOL	Enable setting up of a new tool
9272 USER_CLASS_APPLICATION1 (for ShopMill on NCU (Emb.); protection level 1)	Release machine operating area

9272 USER_CLASS_APPLICATION2 Release parameter operating area (for ShopMill on NCU (Emb.); protection level 1)

9272 USER_CLASS_APPLICATION3 Release program operating area (for ShopMill on NCU (Emb.); protection level 1)

Default setting

These machine data are assigned protection level 7 by default during the standard commissioning 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.

11.1.5 Operator interface for ShopMill on the NCU (HMI Embedded sl)

Default setting

The operating areas ”Machine” and ”Program” are by default hidden without manufacturer password. In the operating area ”Parameter” only the setting data and the zero offsets can be seen without manufacture password.

You can change the display by means of the following machine data

9272 MM_USER_CLASS_APPLICATION [1] = 1
Machine area

9272 MM_USER_CLASS_APPLICATION [3] = 1
Program area

9273 MM_USER_CLASS_APP_PARAMETER [1] = 1
Tool list

9273 MM_USER_CLASS_APP_PARAMETER [2] = 1
Tool wear

9273 MM_USER_CLASS_APP_PARAMETER [3] = 1
OEM tool data

9273 MM_USER_CLASS_APP_PARAMETER [4] = 1
Magazine

9273 MM_USER_CLASS_APP_PARAMETER [6] = 1
R parameters

9273 MM_USER_CLASS_APP_PARAMETER [10] = 1
User data

9414 MM_TM_KIND_OF_TOOLMANAGEMENT = 1
Graphical representation of the tool management

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/, Function Manual on ISO Dialects for SINUMERIK

11.3 Spindle control

The ShopMill spindle control features special properties.

To configure the spindle, see

References: /FB1/, Function Manual on the Basic Machine: Spindles (S1)

End of program

ShopMill distinguishes between M2/M30 (program end of a ShopMill program) and the M function (program end of a program created in the operating mode ”Manual” or ”MDA”) defined in the MD 10714 $MN_M_NO_FCT_EOP.
MD 35040 $MA_SPIND_ACTIVE_AFTER_RESET=2 causes the NCK to switch off the spindle for M2/M30, while it does not do so for the M function defined in MD 10714 $MN_M_NO_FCT_EOP.
This functionality is required, among other things, to be able to start the spindle in manual operation (e.g. for scraping).

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

If a manual spindle control must be implemented using the keys of the machine control panel, it can be accomplished using the following interface signals in the spindle data block:
DB3x.DBX30.0 spindle stop
DB3x.DBX30.1 spindle start CW rotation
DB3x.DBX30.2 spindle start CCW rotation
The spindle can be started and stopped if the channel status is reset (DB21.DBX35.7=1) or the channel status is ”interrupted” (DB21.DBX35.6=1) and the program status 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).

11.4 Analog spindles

ShopMill supports analog spindles with transmitter during thread tapping.
Analog spindles must be used together with a compensation chuck.
The machine 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 channel index of the spindle is located in the display machine data 9705 $MM_CMM_INDEX_SPINDLE. If the respective machine axis index corresponds to one of the two machine data 9426 or 9427, ShopMill recognizes the spindle as an analog spindle. Whether the analog spindle features a transmitter can be determined by means of MD 30200 $MA_NUM_ENCS (0 = no transmitter).

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 program is started via an asynchronous subroutine.

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 commissioning:

REM_DATA.TRC Data which needs to remain stored when the machine is next switched off (e.g. the last selected program) is saved in this program.

11.6 Version display

The boot screen displays the ShopMill version.

The version data of the installed system software are output in a version display.

- For this purpose switch to the CNC ISO operator interface.
- Select the menu ”Diagnostics” —> ”Service displays” —> ”Version”.

More detailed information about the version display can be found in the following documentation:

References:
/IHA/, Commissioning Base Software and HMI Advanced, SINUMERIK 840D sl/840D/840Di;
/BAD/ Operating Manual HMI Advanced, SINUMERIK 840D sl/840D/840Di
BEMsl/ Operating Manual HMI Embedded sl, SINUMERIK 840D sl

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.

More detailed information about the action log can be found in:
References: /IHE/, Commissioning Base Software and HMI–Embedded sl, SINUMERIK 840D sl/840D/840Di/810D

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 50.3 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 can be run not only on special mold–making machines, but also on conventional milling machines for the 2 1/2D machining.
The milling machines must, however, be optimized for processing mold–making programs to achieve the best possible velocity control.

11.8.1 Commissioning

You must perform the following steps to achieve the best possible velocity control:

- Setting NCK machine data
- Optimizing the drive
- Preconfiguring and, if necessary, adapting the cycle ”High Speed Settings”

NCK machine data

The NCK machine data are set in the ”Machine data” mask (see chapter 7.1 ”NCK machine data for ShopMill”).

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 feed forward control using machine–specific machine data, then check these settings based on a circular mold test and contour precision (corners, radii).

The optimization of controllers, jerk values and feed–forward control should be performed with active compressor function so that the compressor function can later be activated without additional re–optimization.
The compressor function is already taken into account for the settings of the machine data in the ”Machine data” mask.
The compressor function is integrated in the option ”Spline interpolation for 3–axis processing” (Order No. 6FC5 800–0AM16–0YB0) or ”Spline interpolation for 5–axis processing” (Order No. 6FC5 800–0AM17–0YB0).

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 is merely used for setting the NCK functions for the velocity control, i.e. the optimization of drives described above is a requirement for it.

The ”High Speed Settings” cycle can be called via the cycle support in the G–code editor of ShopMill.
More detailed information about the cycles ”High Speed Settings” and ”CYC_832T” can be found in:
References: /PGZ/, Programming Manual on Cycles

11.8.2 Data storage, data transfer

Data storage

For the optimization of the velocity control through the ”High Speed Settings” cycle to become effective, it is recommended to divide mold–making programs into a technology program and a geometry program.
The technology program contains fundamental settings such as zero offset, tool, feed, spindle speed, etc., while the geometry program exclusively contains geometry values of the freeform surface to be processed.
Depending upon the application, the size of geometry programs can reach from 500 KB up to 100 MB. Programs of this size can no longer be processed directly in the NCK RAM; instead, they must be processed externally via EXTCALL.

Save the geometry programs

- for the PCU 50.3 (HMI Advanced) either directly on the hard disk or on a network drive;
- for ShopMill on NCU (HMI Embedded sl) either on the CompactFlash card or on a network drive.

Options

Saving to network drives requires the option ”Managing network drives”.

Saving to the user memory of the CompactFlash card requires the option ”256 MB User Memory”.

You can find further information in
References: /IHA/, Commissioning Base Software and HMI Advanced, SINUMERIK 840D sl/840D/840Di;
/IHE/, Commissioning Base Software and HMI Embedded sl, SINUMERIK 840D sl

Data transfer

A mold–making program can be copied directly to the control from a network drive or a USB drive.

- PCU 50.3 (HMI Advanced)
  The programs are copied to the hard disk.
- ShopMill on NCU (HMI Embedded sl)
  The programs are copied to the user memory of the CompactFlash card.

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Abbreviations

A

ASUB	Asynchronous subroutine
BAG	Mode group
BUFF	Buffer
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
FB	Function Block
GUD	Global User Data
HPU	Handheld Programming Unit
IBN	Commissioning
MCP	Machine Control Panel
MD	Machine data
MDA	Manual Data Automatic
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
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
SD	Setting Data
SK	Softkey
SPF	Sub Program File
STL	Statement List
SW	Software
TM	Tool management
T No.	Tool number
TOA	Tool Offset Active: Identifier for tool offsets
WZ	Tool

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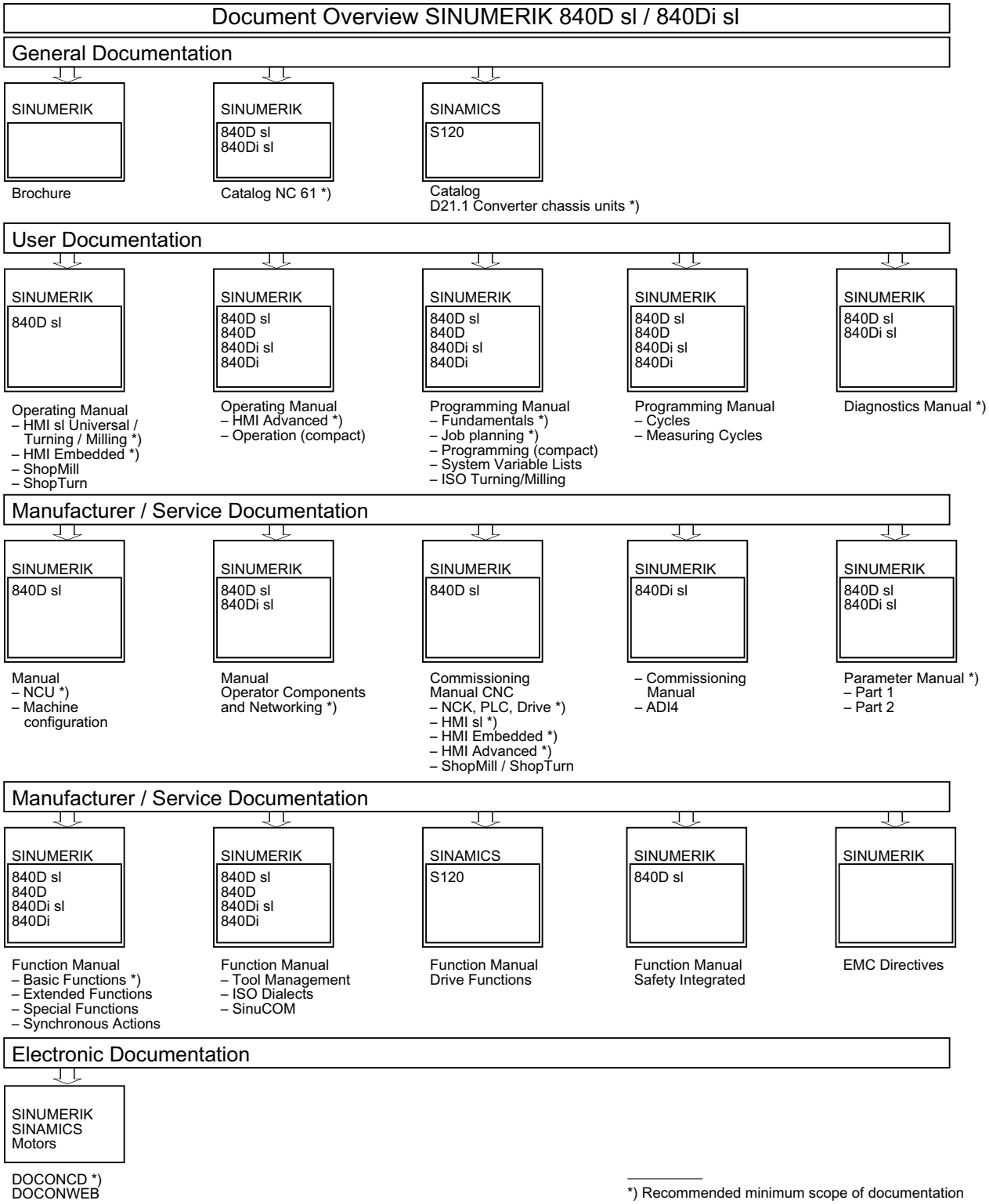

*) Recommended minimum scope of documentation