SIEMENS

SINUMERIK

SINUMERIK 840D sl/828D/802D sl ISO dialects

Function Manual

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Short description

1

Introduction

Part programs from external CNC systems can be read in and executed.

This brochure describes the commissioning required for this and how NC programs from an external CNC system are processed. Functional differences are also explained.

Note

You will find a detailed description of the external program functions in the original documentation provided for the external CNC system.

Terms used

The following terms are defined for this brochure:

- ISO dialect M is similar to the G code of the "Fanuc16-Milling" control system
- ISO dialect T is similar to the G code of the "Fanuc16-Turning" system B control system
- ISO dialect original corresponds to the original Fanuc16 control system

Programming 2

2.1 Function activation

Changeover

The 18800 $MN_EXTERN_LANGUAGE machine datum is used to activate the external language. The ISO dialect M or T language types can be selected via 10880 $MN_EXTERN_CNC_SYSTEM machine datum.

The external language can be activated separately for each channel. For example, channel 1 can run in ISO mode while channel 2 is active in Siemens mode.

The two G commands from group 47 are used to switch from Siemens mode to ISO dialect mode:

- G290: Siemens NC programming language active
- G291: ISO dialect NC programming language active

The active tool, tool compensation and work offsets are retained.

G290 and G291 must be the only components of an NC program block.

Siemens mode

The following conditions are valid in the Siemens mode:

- The default of the G commands can be defined for each channel via the 20150 $MC_GCODE_RESET_VALUE machine datum.
- No language commands from the ISO dialects can be programmed in Siemens mode.

ISO dialect mode

The following conditions apply when ISO dialect mode is active:

- The ISO dialect mode can be set with machine data as the default setting for the control system. In ISO dialect mode, the control system then reboots by default.
- Only G commands from the ISO dialect can be programmed; the programming of Siemens G functions is not possible in ISO mode.
- ISO dialect and Siemens language cannot be mixed in the same NC block.
- G commands cannot be used to switch between ISO dialect M and ISO dialect T
- Subprograms that are programmed in Siemens mode can be called.
- If Siemens functions are to be used, a to Siemens mode must first be made.

PowerOn/Reset

The table below shows the possible combinations of MD10880 $MN_MM_EXTERN_CNC_SYSTEM and MD20150 $MC_GCODE_RESET_VALUE[46]. This defines the Power On/Reset behavior.

Table 2- 1 Function activation

After PowerOn/Reset	$MC_GCODE_RESET_VALUES[46]=	$MN_EXTERN_CNC_SYSTEM =
Siemens mode active, switching to ISO dialect M possible	**1** G290 Siemens mode	**1** ISO dialect M
Siemens mode active, switching to ISO dialect T possible	**1** G290 Siemens mode	**2** ISO dialect T
ISO dialect M active, switching to Siemens mode possible	**2** G291 ISO dialect mode	**1** ISO dialect M
ISO dialect T active, switching to Siemens mode possible	**2** G291 ISO dialect mode	**2** ISO dialect T

Data storage

Imported ISO programs are stored as main programs in the NC data storage under the default address:

_N_WKS_DIR/_N_SHOPMILL_WPD.

The input can be changed by editing the DINO.INI file in the USER folder. More information can be found in the following brochure:

References: SINUMERIK 840D sl/840Di sl/840D/810D Commissioning HMI (IAM), IM4

2.1.1 Switching between the operating modes

G290/291

The following G functions can be used to switch between the Siemens mode and the ISO dialect mode:

- G290 - Siemens NC programming language active
- G291 - ISO Dialect NC Programming language active

The active tool, tool compensation and work offsets are not influenced by the switchover.

G290 and G291 must be programmed alone in an NC block.

G65/66

Macro, non-modal and modal:

The programmed subprogram is called. A switch will only be made to Siemens mode if the PROC instruction is used in the first line of the subprogram.

If such a program ends with M17 or RET, a mode switch is made back to ISO mode during the return.

Siemens up call in ISO mode

Modal and non-modal subprogram calls, e.g.

```
N100 CALL "SHAFT"
or
N100 MCALL SHAFT
or
N100 SHAFT
```

Modal and non-modal subprogram calls with parameter transfer

```
N100 MCALL SHAFT ("ABC", 33.5)
or
N100 SHAFT ("ABC", 33.5)
```

Subprogram calls with path details

```
N100 CALL "/_N_SPF_DIR/SHAFT
or
N100 MCALL /_N_SPF_DIR/SHAFT
or
N100 PCALL /_N_SPF_DIR/SHAFT
```

During subprogram calls, Siemens mode is selected implicitly and a switch is made back to ISO dialect mode at the end of the subprogram.

Modal, non-modal cycles

If a modal or non-modal cycle is programmed in ISO mode, a shell cycle is called.

A switch is made to Siemens mode during this call.

2.2 G commands

The G codes of ISO dialect T relate to G code system B.

The active G codes of ISO mode can be read using system variable $P_EXTGG[...].
The numbers next to the G code specify the respective value in $P_EXTGG[...].
The 20154 EXTERN_GCODE_RESET_VALUES[n] 0, ..., 30 MD is used to define the G codes which are effective in the power up if the NC channel isn't in Siemens mode.

Table 2- 2 The default setting is marked as [1)]

ISO dialect T		ISO dialect M		Description	840D sl	802D sl
Group 1						
G00 [1)]	1	G00 [1)]	1	Rapid traverse	x	x
G01	2	G01	2	Linear movement	x	x
G02	3	G02	3	Circle/helix in clockwise direction	x	x
		G02.2	6	Involute in clockwise direction	x	x
G03	4	G03	4	Circle/helix in counterclockwise direction	x	x
		G03.2	7	Involute in counterclockwise direction	x	x
G33	5	G33	5	Thread cutting with constant lead	x	x
G34	9			Thread cutting with variable lead	x	x
G77	6			Longitudinal turning cycle	x	x
G78	7			Thread cutting cycle	x	x
G79	8			Face turning cycle	x	x
Group 2						
		G17 [1)]	1	XY plane	x	x
		G18	2	ZX plane	x	x
		G19	3	YZ plane	x	x
G96	1			Constant cutting rate on	x	x
G97 [1)]	2			Constant cutting rate off	x	x
Group 3						
G90 [1)]	1	G90 [1)]	1	Absolute programming	x	x
G91	2	G91	2	Incremental programming	x	x
Group 4						
		G22	1	Working area limitation, protection zone 3 on	x	x
		G23 [1)]	2	Working area limitation, protection zone 3 off	x	x
G68	1			Double slide/turret on	x	x
G69 [1)]	2			Double slide/turret off	x	x
Group 5						
		G23 [1)]	2	Inverse-time feedrate (rpm)	x	x
G94	1	G94 [1)]	1	Feedrate in [mm/min, inch/min]	x	x
G95 [1)]	2	G95	2	Revolutional feedrate in [mm/rev, inch/rev]	x	x
Group 6						
G20 [1)]	1	G20 [1)] (G70)	1	Inch input system	x	x
G21	2	G21 (G71)	2	Metric input system	x	x
Group 7						
G40 [1)]	1	G40 [1)]	1	Deselection of cutter radius compensation	x	x
G41	2	G41	2	Compensation left of contour	x	x
G42	3	G42	3	Compensation to right of contour	x	x

ISO dialect T		ISO dialect M		Description	840D sl	802D sl
Group 8						
		G43	1	Positive tool length compensation on	x	x
		G44	2	Negative tool length compensation on	x	x
		G49 [1]	3	Tool length compensation off	x	x
Group 9						
G22	1			Working area limitation, protection zone 3 on	x	x
G23 [1]	2			Working area limitation, protection zone 3 off	x	x
		G73	1	Deep hole drilling cycle with chip breakage	x	x
		G74	2	Left tapping cycle	x	x
		G76	3	Fine drill cycle	x	x
		G80 [1]	4	Cycle off	x	x
		G81	5	Drilling cycle counterboring	x	x
		G82	6	Countersink drilling cycle	x	x
		G83	7	Deep hole drilling cycle with chip removal	x	x
		G84	8	Right tapping cycle	x	x
		G85	9	Drilling cycle	x	x
		G86	10	Drilling cycle, retraction with G00	x	x
		G87	11	Reverse countersinking	x	x
		G89	13	Drilling cycle, retraction with machining feedrate	x	x
Group 10						
G80 [1]	1			Drilling cycle off	x	x
G83	2			Front face deep hole drilling	x	x
G84	3			Front face tapping	x	x
G85	4			Front face drilling cycle	x	x
G87	5			Side surface deep hole drilling	x	x
G88	6			Side surface tapping	x	x
G89	7			Side surface drilling	x	x
		G98 [1]	1	Return to starting point in fixed cycles	x	x
		G99	2	Return to point R in fixed cycles	x	x
Group 11						
G98 [1]	1			Return to starting point in drilling cycles	x	x
G99	2			Return to point R in drilling cycles	x	
		G50 [1]	1	Scaling off	x	x
		G51	2	Scaling on	x	x
Group 12						
G66	1	G66	1	Macro module call	x	x
G67 [1]	2	G67 [1]	2	Delete macro module call	x	x
Group 13						
G96	1	G96	1	Constant cutting rate on	x	x
		G97 [1]	2	Constant cutting rate off	x	x
Group 14						
G54 [1]	1	G54 [1]	1	Selecting work offset	x	x

ISO dialect T		ISO dialect M		Description	840D sl	802D sl
G55	2	G55	2	Selecting work offset	x	x
G56	3	G56	3	Selecting work offset	x	x
G57	4	G57	4	Selecting work offset	x	x
G58	5	G58	5	Selecting work offset	x	x
G59	6	G59	6	Selecting work offset	x	x
G54 P{1...48}	1	G54 P{1...48}	1	Extended work offsets	x	x
G54.1	7	G54.1	7	Extended work offsets	x	x
G54 P0	1	G54 P0	1	"external work offset"	x	x
Group 15						
		G61	1	Exact stop modal	x	x
		G62	4	Automatic corner override	x	x
		G63	2	Tapping mode	x	x
		G64 [1)]	3	Continuous-path mode	x	x
Group 16						
G17	1			XY plane	x	x
G18 [1)]	2			ZX plane	x	x
G19	3			YZ plane	x	x
		G68	1	Rotation ON 2D 3D	x	x
		G69 [1)]	2	Rotation OFF	x	x
Group 17						
		G15 [1)]	1	Polar coordinates off	x	x
		G16	2	Polar coordinates on	x	x
Group 18 (non-modal effective)						
G04	1	G04	1	Dwell time in [s] or spindle revolutions	x	x
G05	20	G05	18	High-speed cycle cutting	x	x
G05.1	22	G05.1	20	High-speed cycle -> Call CYCLE305	x	x
G07.1	18	G07.1	16	Cylindrical interpolation	x	x
		G08	12	Pre-control ON/OFF	x	--
		G09	2	Exact stop	x	x
G10	2	G10	3	Write work offset/tool compensation	x	x
G10.6	19	G10.6	17	Rapid lifting ON/OFF (T) Retraction from contour (POLF) (M)	x	x
		G11	4	End parameter entry	x	x
G27	16	G27	13	Referencing check (under development)	x	x
G28	3	G28	5	Approaching 1st reference point	x	x
G30	4	G30	6	Approaching 2nd/3rd/4th reference point	x	x
G30.1	21	G30.1	19	Reference point position	x	x
G31	5	G31	7	Measuring with touch-trigger probe	x	x
G52	6	G52	8	Programmable work offset	x	x
G53	17	G53	9	Approach position in machine coordinate system	x	x
G60	24	G60	22	Directed positioning	x	x
G65	7	G65	10	Macro call	x	x
G70	8			Finishing cycle	x	x

ISO dialect T		ISO dialect M		Description	840D sl	802D sl
G71	9			Stock removal cycle, longitudinal axis	x	x
G72	10			Stock removal cycle transverse axis	x	x
		G72.1	14	Contour repetition with rotation	x	--
		G72.2	15	Linear contour repetition	x	--
G73	11			Contour repetition	x	x
G74	12			Deep-hole boring and grooving in the longitudinal axis (Z)	x	x
G75	13			Deep-hole boring and grooving in the transverse axis (X)	x	x
G76	14			Multiple thread cutting cycle	x	x
G92	15	G92	11	Setting actual value, spindle speed limitation	x	x
G92.1	23	G92.1	21	Delete actual value, reset the WCS	x	x
Group 20						
G50.2 [1)]	1			Multi-edge turning OFF	x	--
G51.2	2			Multi-edge turning ON	x	--
Group 21						
G13.1 [1)]	1			TRANSMIT OFF	x	x
G12.1	2			TRANSMIT ON	x	x
Group 22						
		G50.1	1	Mirroring on programmed axis OFF	x	x
		G51.1	2	Mirroring on programmed axis ON	x	x
Group 25						
		G13.1	1	Polar coordinates interpolation OFF	x	x
		G12.1	2	Polar coordinates interpolation ON	x	x
Group 31						
G290 [1)]	1	G290 [1)]	1	Select Siemens mode	x	x
G291	1	G291	1	Select ISO dialect mode	x	x
x means G code can be used, -- means G code cannot be used						

Modally effective G commands

Modally effective G commands which have an identical function in both systems (Siemens and ISO dialect) are treated as follows:

When programming these G codes in one language, the corresponding G code for the other language is determined and activated. The following G codes are affected by this:

Table 2- 3 G codes have an identical function in Siemens mode and ISO dialect mode

G commands in Siemens mode	Corresponding G commands ISO dialect T	Corresponding G commands ISO dialect M
Group 1: G00, G01, G02, G03, G33	Group 1: G00, G01, G02, G03, G33	Group 1: G00, G01, G02, G03, G33
Group 6: G17, G18, G19	Group 16: G17, G18, G19	Group 2: G17, G18, G19
Group 7: G40, G41, G42	Group 7: G40, G41, G42	Group 7: G40, G41, G42
Group 8: G54 to G554		Group 14: G54 to G59, G54 P1 to P48
Group 10: G60, G64	Group 18: G60, G64	Group 18: G60, G64
Group 13: G700, G710	Group 6: G20, G21	Group 6: G20, G21

G commands in Siemens mode	Corresponding G commands ISO dialect T	Corresponding G commands ISO dialect M
Group 14: G90, G91	Group 3: G90, G91	Group 3: G90, G91
Group 15: G94 G95 G96 G961 G97 G971	Group 5: G94 Group 2: G97 Group 5: G95 Group 2: G97 Group 5: G95 Group 2: G96 Group 5: G94 Group 2: G96 Group 5: G95 Group 2: G97 Group 5: G94 Group 2: G97	Group 5: G94 Group 13: G97 Group 5: G95 Group 13: G97 Group 5: G95 Group 13: G96 Group 5: G94 Group 13: G96 Group 5: G95 Group 13: G97 Group 5: G94 Group 13: G97

Note

If individual G commands from the groups stated in the table cannot be depicted, the basic setting saved in MD20154 $MC_EXTERN_GCODE_RESET_VALUES and/or MD20152 $MC_GCODE_RESET_VALUES is activated.

Example: ISO mode

```
N5 G00 X100. Y100.
N10 G90                ;activates G90 in ISO mode group 3
                       ;in Siemens mode group 14
N15 G290               ;switches over to Siemens, G90 is active
N20 G91                ;activates G91 in ISO mode group 3
                       ;in Siemens mode group 14
N25 G291               ;switches over to ISO mode
N30 G291               ;G91 is active
```

2.2.1 Display of the G code

The G code must always be displayed in the same language (Siemens or ISO Dialect) as the relevant current block. If the display of the blocks is suppressed with DISPLOF, the current G codes continue to be displayed in the same language as the active block.

Example

The G functions of the ISO dialect mode are used to call the Siemens standard cycles. To do this, DISPLOF is programmed at the start of the relevant cycle; this way the G functions that are programmed in the ISO dialect language continue to be displayed.

```
PROC CYCLE328 SAVE DISPLOF
N10 ...
...
N99 RET
```

Procedure

The Siemens shell cycles are called via main programs. The Siemens mode is selected automatically by calling the shell cycle.

With DISPLOF, the block display is frozen on calling the cycle; the G code continues to be displayed in ISO mode.

The G codes that were changed in the shell cycle, are reset to their original status at the end of the cycle with the "SAVE" attribute.

2.2.2 Display of non-modal G codes

The external non-modal G codes (group 18) are no longer reset when changing block if these G codes call subprograms. The G codes remain visible in the display until this subprogram is exited.

However if a switch is made in the subprogram to the external language mode and if another G code from group 18 is programmed, the previous value is overwritten and the new value retained until the return.

Example:

Main program	Display group 18
N05 G00 X0 Y0 empty	
N08 G27 X10 -> calls Cycle328	Empty
N09 M0	Empty
N40 M30	Empty

Cycle328 subprogram	Display group 18
N100 G290	G27
N102 X=$C_X	G27
N103 M0	G27
N104 G291	G27
N105 G30 X10 Y12 Z13	G30
N120 M99	G30

2.2.3 G code output to PLC

The response of G group transfer to PLC is described in MD22515 $MC_GCODE_GROUPS_TO_PLC_MODE.

With the previous response, the G group is the array index of a 64-byte field (DBB 208 - DBB 271). At the most, the 64th G group can therefore be reached. Only the G groups of the standard or external language can be displayed.

With the new response, data storage in the PLC is 8 bytes at most (DBB 208 - DBB 215), i.e. a total of 8 G groups can be output at most.

With this response, the array index of the following machine data is the same as the array index of data storage in the PLC (DBB 208 - DBB215):

MD22515 $MC_GCODE_GROUPS_TO_PLC[ ] and/or

MD22512 $MC_EXTERN_GCODE_GROUPS_TO_PLC[ ]

The G code group from MD22515 $MC_GCODE_GROUPS_TO_PLC[ ] is output in DBB 208.

The benefit of this is that G codes of the Siemens and ISO mode can be output at the same time.

Since only the G code of one language can be output in a DBB2xx, each index (0 -7) may only be set for one of the two machine data and 0 must be entered for the other MD. Faults are reported with alarm 4045 "Channel %1 conflict between machine datum %2 and machine datum %3".

Example

```
$MC_GCODE_GROUPS_TO_PLC[0]=3
$MC_GCODE_GROUPS_TO_PLC[1]=0
$MC_GCODE_GROUPS_TO_PLC[2]=0
$MC_GCODE_GROUPS_TO_PLC[3]=0
$MC_GCODE_GROUPS_TO_PLC[4]=1
$MC_GCODE_GROUPS_TO_PLC[5]=2
$MC_GCODE_GROUPS_TO_PLC[6]=0
$MC_GCODE_GROUPS_TO_PLC[7]=0
```

```
$MC_EXTERN_GCODE_GROUPS_TO_PLC[0]=0
$MC_EXTERN_GCODE_GROUPS_TO_PLC[1]=3
$MC_EXTERN_GCODE_GROUPS_TO_PLC[2]=18
$MC_EXTERN_GCODE_GROUPS_TO_PLC[3]=1
$MC_EXTERN_GCODE_GROUPS_TO_PLC[4]=0
$MC_EXTERN_GCODE_GROUPS_TO_PLC[5]=0
$MC_EXTERN_GCODE_GROUPS_TO_PLC[6]=6
$MC_EXTERN_GCODE_GROUPS_TO_PLC[7]=31
```

The following G codes are available on the PLC:

```
DBB 208 = Group 03 Siemens
DBB 209 = Group 03 ISO dialect
DBB 210 = Group 18 ISO dialect
DBB 211 = Group 01 ISO dialect
DBB 212 = Group 01 Siemens
DBB 213 = Group 02 Siemens
DBB 214 = Group 06 ISO dialect
DBB 215 = Group 31 ISO dialect
```

Example of incorrect configuration:

```
$MC_GCODE_GROUPS_TO_PLC[0]=3
$MC_GCODE_GROUPS_TO_PLC[1]=0
$MC_GCODE_GROUPS_TO_PLC[2]=0
$MC_EXTERN_GCODE_GROUPS_TO_PLC[0]=3 ->
```

Alarm 4045, channel K1 conflict between machine datum {S
$MC_GCODE_GROUPS_TO_PLC} and machine datum {S
$MC_EXTERN_GCODE_GROUPS_TO_PLC}

$MC_EXTERN_GCODE_GROUPS_TO_PLC[1]=0
$MC_EXTERN_GCODE_GROUPS_TO_PLC[2]=18

This process can now be used to display G codes of standard mode and ISO dialect mode at the same time.

2.2.4 Mapping of ISO functions on the Siemens frames (up to powerline 7.04.2, solution line)

The following figure shows the mapping of ISO functions on the Siemens frames.

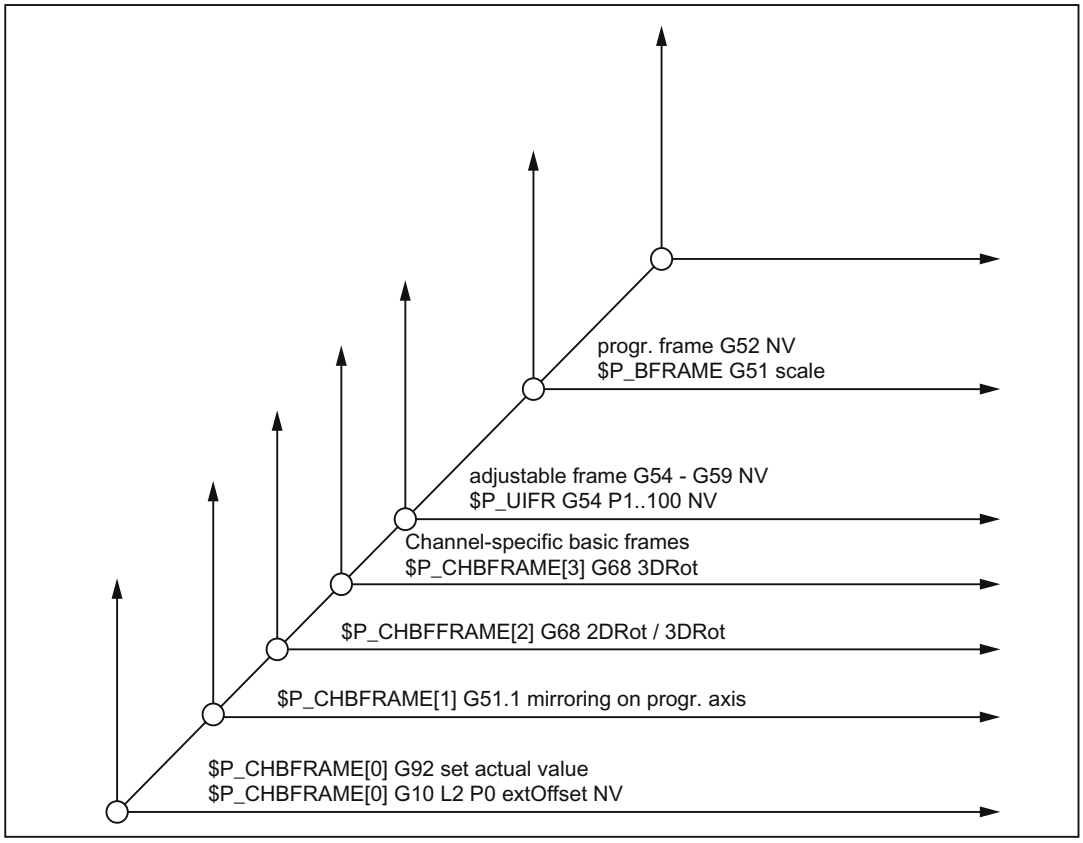


Figure 2-1 Mapping of ISO functions on the Siemens frames

The work offsets present in ISO mode are mapped on the existing Siemens frames. **There are no separate frames for ISO mode.** Active work offsets are calculated in both language modes.

Changes in ISO mode impact directly in Siemens mode and vice versa.

There are work offsets in both ISO dialect T and ISO dialect M:

- G52 is a programmable additive NV, effective until the program end or reset
- G54 to G59 are adjustable work offsets
- G54 P1...P100 are extra adjustable work offsets
- G54 P0 is an "external extOffset NV"

2.2.5 Decoupling frames between Siemens and ISO mode (as of powerline 7.04.02, solution line)

Frames

In ISO mode, some G codes could be found in the programmable frame $P_FRAME, the adjustable frame $P_UIFR and three basic frames $P_CHBFRAME[ ]. If a switch is made from ISO mode to Siemens mode, these frames are not available to the Siemens language user. The following are affected:

G52 programmable work offset -> progr. frame $P_PFRAME

G51 scaling -> progr. frame $P_BFRAME SCALE

G54-G59 work offset -> adjustable frame $P_UIFR

G54 P1..100 work offset -> adjustable frame $P_UIFR

G68 3D Rot -> basic frame $P_CHBFRAME[3]

G68 2D Rot -> basic frame $P_CHBFRAME[2]

G51.1 mirroring -> basic frame $P_CHBFRAME[1]

G92 set actual value -> basic frame $P_CHBFRAME[0]

G10 L2 P0 ext. work offset -> basic frame $P_CHBFRAME[0]

There are four new system frames, $P_ISO1FRAME to $P_ISO4FRAME for decoupling the frames in question between Siemens and ISO mode. The frames are created with the 28082 $MC_MM_SYSTEM_FRAME_MASK machine datum, bits 7 to 10. The reset behavior is set using the 24006 $MC_CHSFRAME_RESET_MASK machine datum, bits 7 to 10.

The following figure shows the G codes in ISO mode and the assignment of frames, when system frames $P_ISO1FRAME to $P_ISO4FRAME, $P_SETFRAME and $P_EXTFRAME are created.

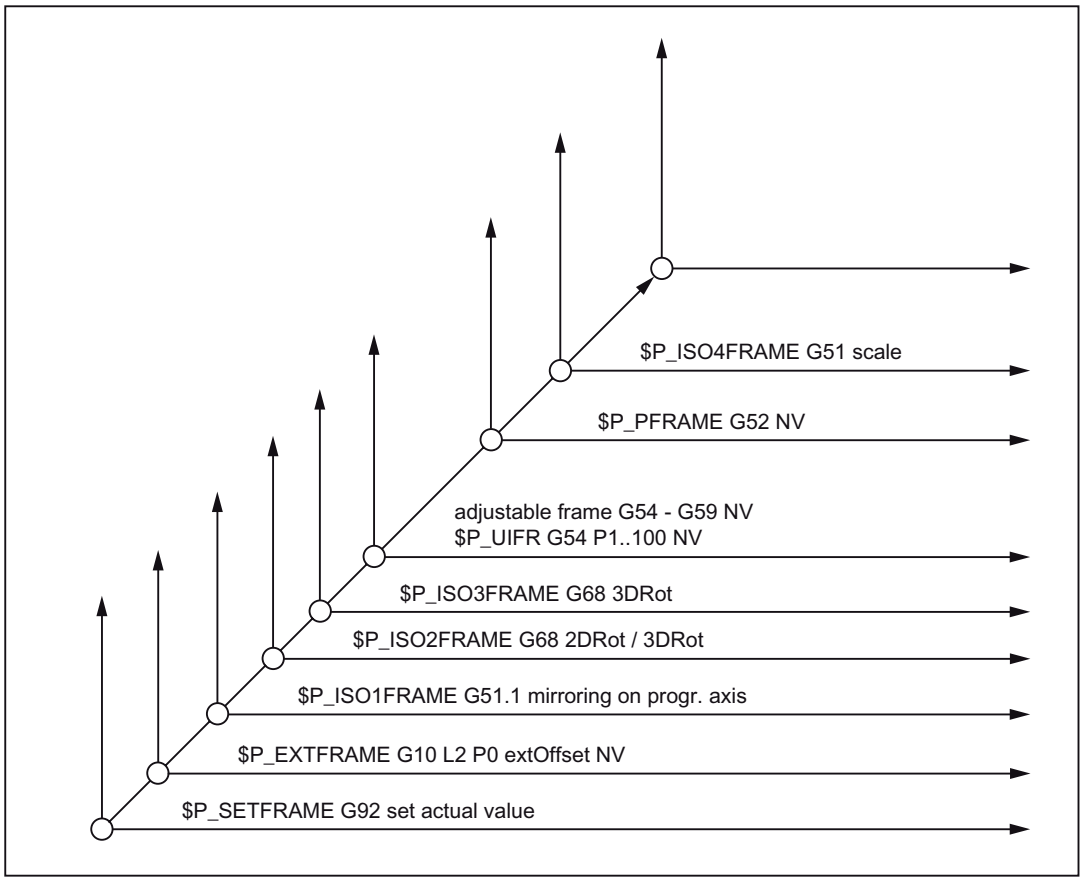


Figure 2-2 Mapping of ISO functions on the ISO and Siemens frames

Note

If new frames are created, the ISO G codes write in these frames. If they are not created, the frames are created as described in the previous chapter.

The section below shows which G codes describe which frames, how they are created and how the frames' reset behavior must be set to ensure a compatible response to the ISO mode original. The reset behavior may be set to deviate from the ISO mode original with the MD described. This may be necessary when switching from ISO mode to Siemens mode.

G51 scaling

G51 X10 writes in	$P_ISO4FRAME
Component	TRANS, SCALE
Create	$MC_MM_SYSTEM_FRAME_MASK bit 10 = 1
Reset behavior	Delete frame $MC_CHSFRAME_RESET_MASKBit 10 = 0

G52 programmable work offset

G52 X10 writes in	$P_PFRAME
Component	TRANS
Create	is always present
Reset behavior	is deleted at Reset

G54 - G59 P1...100 adjustable work offset

G52 - G59	$P_UIFER
Component	TRANS
Create	is always present
Reset behavior	G54 is active after Reset $MC_EXTERN_GCODE_RESET_VALUES[13] = 1

G68 3DRot

G68 X Y I J K R	$P_ISO3FRAME
Component	TRANS, SCALE
Create	$MC_MM_SYSTEM_FRAME_MASK bit 9 = 1
Reset behavior	Delete frame $MC_CHSFRAME_RESET_MASKBit 9 = 0

G68 2DRot

G68 X Y R	$P_ISO2FRAME
Component	TRANS, SCALE
Create	$MC_MM_SYSTEM_FRAME_MASK bit 8 = 1
Reset behavior	Delete frame $MC_CHSFRAME_RESET_MASKBit 8 = 0

G51.1 mirroring

G51.1 X Y	$P_ISO1FRAME
Component	TRANS, MIRROR
Create	$MC_MM_SYSTEM_FRAME_MASK bit 7 = 1
Reset behavior	Delete frame $MC_CHSFRAME_RESET_MASKBit 7 = 0

G92 set actual value

G92 X Y R	$P_SETFRAME
Component	TRANS
Create	$MC_MM_SYSTEM_FRAME_MASK bit 0 = 1
Reset behavior	Frame is retained after Reset $MC_CHSFRAME_RESET_MASKBit 0 = 1

G10 L2 P0

G10 L2 P0	$P_EXTFRAME
Component	TRANS
Create	$MC_MM_SYSTEM_FRAME_MASK bit 1 = 1
Reset behavior	Delete frame $MC_CHSFRAME_RESET_MASKBit 1 = 0

If all frames are created, the frames with FINE components no longer have to be configured for ISO mode. The MD18600 $MN_MM_FRAME_FINE_TRANS does not have to be set to 1. If a switch is made from ISO mode to Siemens mode and a function used there which requires a fine offset (e.g. G58, G59), $MN_MM_FRAME_FINE_TRANS = 1 must always be true.

G54.1

G54.1 Pxx is an alternative way of writing G54 Pxx. The functionality is identical. The P address must always be programmed in the block for G54.1. If P is not programmed, alarm 12080 (syntax fault) is output.

Display of extended work offset G54 Pxx

In the past when working in ISO dialect T, G54.1 P.. could not be programmed. G code group 14 in ISO dialect T has now had G code G54.1 added to it and G54.1 is now displayed for the programmed P by default.

When programming G54 Pxx or G54.1 Pxx, to date when working in ISO dialect M, G code display G54.1 was used.

MD20734 $MC_EXTERN_FUNCTION_MASK bit 11 can now be used to activate the system such that the programmed P is also displayed after the dot in the G code display.

Programmed	Bit 11 = 1	Bit 11 = 0
G54 P1	Display G54P1	G54.1
G54 P28	Display G54P28	G54.1
G54.1 P28	Display G54P28	G54.1
G54 P48	Display G54P48	G54.1
G54.1 P48	Display G54P48	G54.1

2.2.6 Writing work offset with G10

G10 can be used to write out the work offsets from the part program.

```
G10 L2 P1...P6 X.. Y..          ;G54.. G59
G10 L20 P1...P100               ;additional adjustable NV
G10 L2 P0                       ;external extOffset NV
```

These work offsets are mapped on the same frames as the work offsets which already exist for ISO dialect M.

Note

There are no additional work offsets for SINUMERIK 802D sl.

Decoupling the frames between Siemens and ISO mode (solution line)

The G10 command is extended for **ISO dialect T**:

Writing system data
G10 Pxx X Y Z ;writing tool compensation data

Depending on the MD20734 $MC_EXTERN_FUNCTION_MASK, bit 1, G10 Pxx is used to write tool geometry or tool wear.

$MC_EXTERN_FUNCTION_MASK, bit 1 = 0:
P > 100 writing geometry values
P < 100 writing wear values

$MC_EXTERN_FUNCTION_MASK, bit 1 = 1:
P > 10000 writing geometry values
P < 10000 writing wear values

See also

Decoupling frames between Siemens and ISO mode (as of powerline 7.04.02, solution line 1.4) (Page 20)

2.2.7 Programming the decimal point

Overview

In the ISO dialect mode, there are two notations for weighting programmed values without a decimal point:

- **Pocket calculator notation**

  Values without decimal points are interpreted as mm, inch or degree.

- **Standard notation**

  Values without decimal point are multiplied by a conversion factor.

The setting is done over MD10884 $MN_EXTERN_FLOATINGPOINT_PROG.

There are two different conversion factors, **IS-B** and **IS-C**. This evaluation relates to the addresses X Y Z U V W A B C I J K Q R and F.

Example:

Linear axis in mm:

- X100.5

  corresponds to a value with decimal point: 100.5 mm
- X 1000
  - Calculator notation: 1,000 mm
  - Standard notation:

    IS-B: 1,000* 0.001= 1 mm

    IS-C: 1,000* 0.0001= 0.1 mm

ISO dialect M

Different conversion factors for IS-B and IS-C

Address	Unit	IS-B	IS-C
Linear axis	mm inch	0.001 0.0001	0.0001 0.00001
Rotary axis	deg	0.001	0.0001
F feed G94 (mm/inch per min.)	mm inch	1 0.01	1 0.01
F feed G95 (mm/inch per min.)	mm inch	0.01 0.0001	0.01 0.0001
F thread lead	mm inch	0.01 0.0001	0.01 0.0001
C chamfer	mm inch	0.001 0.0001	0.0001 0.00001
R radius, G10 toolcorr	mm inch	0.001 0.0001	0.0001 0.00001
Q	mm inch	0.001 0.0001	0.0001 0.00001
I, J, K IpoParameter	mm inch	0.001 0.0001	0.0001 0.00001
G04 X or U	s	0.001	0.001
A angle contour definition	deg	0.001	0.0001
G74, G84 tapping cycles $MC_EXTERN_FUNCTION_MASK Bit 8 = 0 F as feed such as G94, G95 Bit 8 = 1 F as thread lead			

ISO dialect T

Different conversion factors for IS-B and IS-C

Address	Unit	IS-B	IS-C
Linear axis	mm inch	0.001 0.0001	0.0001 0.00001
Rotary axis	deg	0.001	0.0001
F feed G94 (mm/inch per min.)	mm inch	1 0.01	1 0.01
F feed G95 (mm/inch per rotation) $MC_EXTERN_FUNCTION_MASK			
Bit 8 = 0	mm inch	0.01 0.0001	0.01 0.0001
Bit 8 = 1	mm inch	0.0001 0.000001	0.0001 0.000001
F thread lead	mm inch	0.0001 0.000001	0.0001 0.000001
C chamfer	mm inch	0.001 0.0001	0.0001 0.00001
R radius, G10 toolcorr	mm inch	0.001 0.0001	0.0001 0.00001
I, J, K Ipo parameters	mm inch	0.001 0.0001	0.0001 0.00001
G04 X or U		0.001	0.001
A angle contour definition		0.001	0.0001
G76, G78 tapping cycles $MC_EXTERN_FUNCTION_MASK Bit 8 = 0 F as feed such as G94, G95 Bit 8 = 1 F as thread lead			
G84, G88 tapping cycles $MC_EXTERN_FUNCTION_MASK			
Bit 9 = 0 G95 F	mm inch	0.01 0.0001	0.01 0.0001
Bit 8 = 1 G95 F	mm inch	0.0001 0.000001	0.0001 0.000001

2.2.8 Rapid lifting with G10.6

Function

A retraction position for the rapid lifting of a tool can be activated with G10.6 <Axis position> (e.g., in case of tool breakage). The retraction motion itself is started with a digital signal. The NC's 2nd rapid input is used as the start signal.

Another rapid input (1-8) can also be selected with the 10820 $MN_EXTERN_INTERRUPT_NUM_RETRAC machine datum.

In Siemens mode, activation of the retraction motion comprises several part program commands.

`N10 G10.6 X19.5 Y33.3` give rise to NCK internal:

```
N10 SETINT (2) PRIO=1 CYCLE3106 LIFTFAST        ;activate interrupt input
N30 LFPOS                                       ;select lifting mode
N40 POLF[X]=19.5 POLF[Y]=33.3                   ;program lifting positions for
                                                ;x19.5 and y33.3
N70 POLFMASK(X, Y)                              ;activate retraction of x and
                                                ;y axis
```

These part program commands are combined internally to one block with G10.6.

An interrupt program (ASUB) must also be defined to activate an interrupt input (SETINT(2)). If no such program is defined, the part program cannot be continued because it is aborted after the retraction motion with a reset alarm. The interrupt program (ASUB) CYCLE3106.spf is always used for the rapid retraction with G10.6. If the CYCLE3106.spf is not available in the part program memory, the alarm 14011 "Program CYCLE3106 not available or not released for processing" is output with G10.6 in a part program block.

The response of the control system after the rapid retraction is defined in ASUB CYCLE3106.spf. If the axes and the spindle are stopped after the rapid retraction, M0 and M5 must be programmed in CYCLE3106.spf. If CYCLE3106.spf is a dummy program that contains only M17, the part program is continued without any interruption after the rapid retraction.

If rapid retraction is activated with the programming G10.6 <Axis position>, then the change in input signal of the 2nd NC rapid input from 0 to 1 aborts the current movement and the position programmed in the G10.6 block is moved at rapid traverse. Here, the positions are approached as absolute or incremental, as programmed in the G10.6 block.

The function is deactivated with G10.6 (without position specification). Rapid retraction via the input signal of the 2nd rapid NC input is blocked.

Siemens

The rapid lifting function with G10.6 can be partly covered with the function POLF[<axis name>] = <retraction position>. The function also retracts to the programmed position. ISO dialect original's functionality is not however retained. If the interrupt point cannot be approached directly, the obstruction must be bypassed manually.

Literature: /PGA/, Programming Guide Job Planning, Section "Extended Stop and Retract"

Constraints

Only one axis can be programmed for rapid retraction.

2.2.9 Multiple-start threads with G33

The syntax G33 X.. Z.. F.. Q.. is used in ISO dialect T and M mode to program multiple-start threads. The following applies:

X.. Z.. = End point of the thread

F.. = Thread lead

Q.. = Starting angle

Threads with offset slides are programmed by specifying the mutually offset start points in the G33 block. The starting point offset is specified as the absolute angle position under the address "Q". The related setting datum 42000 ($SD_THREAD_START_ANGLE) is modified accordingly.

Example:

Q45000 means: Start offset 45.000 degrees

Range of values: 0.0000 to 359.999 degrees

The start angle must always be programmed as an integer. The input resolution of the angular data is 0.001 degree.

Example:

```
N200 X50 Z80 G01 F.8 G95 S500 M3
N300 G33 Z40 F2 Q180000
```

A thread with a lead of 2mm and a starting point offset of 180 degree is produced.

2.2.10 Thread with variable lead G34 (ISO dialect T)

The syntax G34 X.. Z.. F.. K.. is used in ISO dialect T mode to program threads with variable lead. The following applies:

X.. Z..= End point of the thread

F..= Thread lead

K..= Increase in thread lead (positive value) or decrease in thread lead (negative value)

G34 is used to increment or decrement the lead during each spindle revolution by the value programmed under address K.

Example:

```
N200 X50 Z80 G01 F.8 G95 S50 M3
N300 G91 G34 Z25.5 F2 K0.1
```

The programmed distance of 25.5 mm corresponds to 10 spindle revolutions.

2.2.11 Dwell time in spindle revolutions G04

MD20734 $MC_EXTERN_FUNCTION_MASK, bit 2 is used to determine how the programmed dwell time is interpreted in a G04 block. The dwell time can be programmed with G04 X U or P.

Bit 2 = 0: Dwell time is always interpreted in [s].

Bit 2 = 1: If G95 is active, dwell time is interpreted in spindle revolutions.

In the instance of standard notation, X and U values without a decimal point are converted into internal units depending on IS-B or IS-C. P is always interpreted in internal units.

Example:

```
N5 G95 G04 X1000
```

Standard notation 1000 * 0.001 = 1 spindle revolution

Pocket calculator notation: 1000 spindle revolutions

2.2.12 Scaling (G50, G51) and mirroring G50.1, G51.1 (ISO dialect M)

The selection for scaling and mirroring takes place with G51, G51.1.

A distinction is made between two options in scaling:

- Axial scaling with the parameters I, J, K

  If I, J, K is not programmed in the G51 block, the relevant default value from the setting data 43120 DEFAULT_SCALE_FACTOR_AXIS is effective.

  Negative axial scaling factors lead additionally to mirroring.

- Scaling in all axes with the scaling factor P

  If P is not written in the block G51, the default value from the setting data is effective. Negative P values are not possible.

  The scaling factors are multiplied either with 0.001 or 0.00001.

Note

If a factor other than "1" is programmed for the I, J, K parameters, or if there is no address (default value for I, J, K is effective), the contour is also scaled.

Example

```
00512 (part program)
N10 G17 G90 G00 X0 Y0              ; Approach start position
N30 G01 G94 F6000
N32 M98 P0513                      ; 1) Contour programmed as in the subprogram
N34 G51 X0. Y0. I-1000 J1000       ; 2) Mirror contour by X
```

```
N36 M98 P0513
N38 G51 X0. Y0. I-1000 J-1000       ; 3) Mirror contour by X and Y
N40 M98 P0513
N42 G51 X0. Y0. I1000 J-1000        ; 4) Mirror contour by Y
N44 M98 P0513
N46 G50                             ; Scaling and mirroring deselection
N50 G00 X0 Y0
N60 M30
00513 (subprogram)
N10 G90 X10. Y10.
N20 X50
N30 Y50
N40 X10. Y10.
N50 M99
```

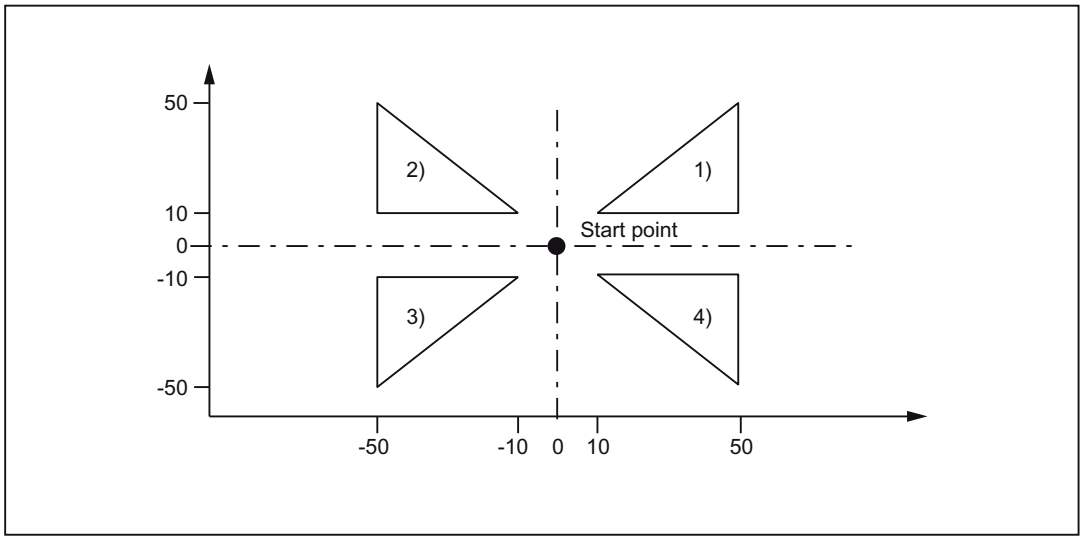


Figure 2-3 Scaling and mirroring

System parameter setup for the scaling and mirroring example:

MD22910 $MC_WEIGHTING_FACTOR_FOR_SCALE = 0

MD22914 $MC_AXES_SCALE_ENABLE = 1

MD10884 $MN_EXTERN_FLOATINGPOINT_PROG = 0

MD10886 $MN_EXTERN_INCREMENT_SYSTEM = 0

When MD22914 $MC_AXES_SCALE_ENABLE = 0, axial scaling is not possible.

When scaling, the reference point is always the workpiece zero, the reference point cannot be programmed.

Mirroring

G51.1 can be used to mirror workpiece shapes on coordinate axes.

Mirroring takes place on a mirroring axis which is parallel to X, Y or Z and whose position is programmed with X, Y or Z. G51.1 X0 is used to mirror on the X axis, G51.1 X10 is used to mirror on a mirroring axis that runs 10 mm parallel to the X axis.

All axes in the channel and not just the geometry axes can be mirrored.

G51.1 has an additive effect, i.e. following N5 G51.1 X10 and N10 G51.1 Y10, mirroring in X and V is active.

Example: G51.1 X80.

Mirroring is undertaken on a mirroring axis which is parallel to Y and which the X axis bisects at position 80.

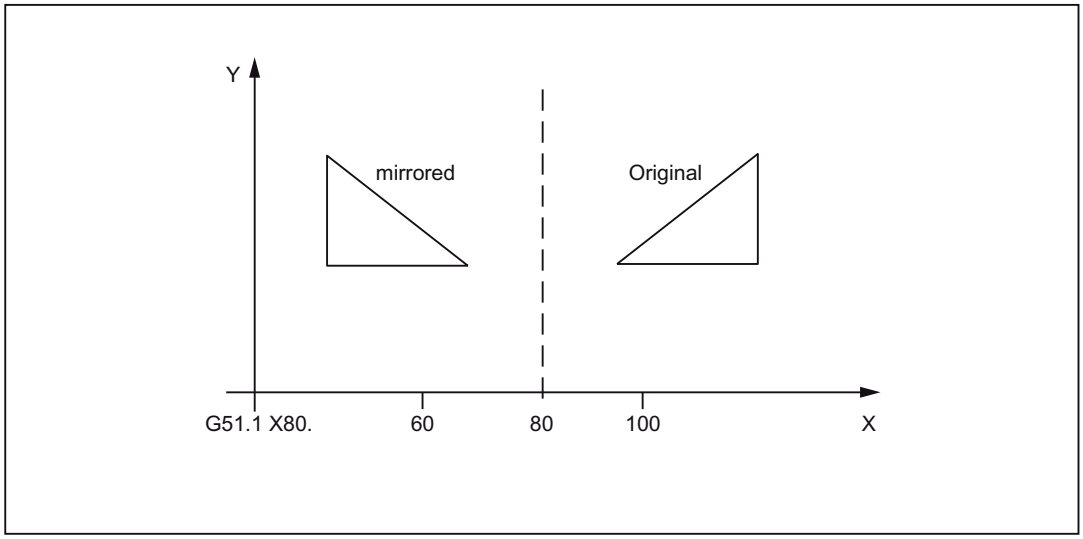


Figure 2-4 Mirroring on a mirroring axis parallel with Y

If standard notation is active (see "Decimal point programming" chapter), the axis positions without a decimal point are interpreted in internal units.

Mirroring with G50.1 X0 Y0 is deselected. Deselection by axis is also possible. Following G50.1 X0, only mirroring in the X axis is deselected, all mirroring in other axes remains active.

G51.1 and G50.1 make up a block.

G51.1 is mapped in the channel-specific basic frame [1].
MD28081 $MC_MM_NUM_BASE_FRAMES >=2 must be set for this.

If the basic frame [1] is changed in Siemens mode, this impacts directly on function in ISO mode.

If the frame is deleted in all frame components, this corresponds to G50.1 X0 Y0.. in all axes.

G51.1 is deselected with Reset.

See also

Decoupling frames between Siemens and ISO mode (as of powerline 7.04.02, solution line 1.4) (Page 20)

Mapping of ISO functions on the Siemens frames (up to powerline 7.04.2, solution line 1.4) (Page 19)

2.2.13 G60 directed positioning

Does not function in SINUMERIK 802D sl.

G60 is used in ISO dialect original to compensate for backlash. In Sinumerik, this is achieved using internal backlash compensation, which is why Siemens mode does not have a G function to match the G60 used in ISO dialect original.

A G macro call cannot take the place of G60 because two subprogram calls cannot be undertaken in an NC block. Because directed positioning (backlash) must be executed before the NC block is processed, calling a G macro at the end of the block would be too late.

Since G60 is used to compensate for backlash and this function can be activated using the axial machine datum $MA_BACKLASH[ ], G60 is skipped in ISO mode without triggering a response.

If the G60 programming is to be taken into account when processing shell cycles, this information is made available in cycle variable $C_G60_PROG. If G60 is programmed, $C_G60_PROG = 1 is set and $C_G60_PROG is deleted again when returning to the subprogram. If a block also needs to contain information as to whether the cycle call is programmed, this is obtained from cycle variable $C_G_PROG. A G60 functionality can be added in the shell cycles using the information from these two system variables.
The information regarding whether a modal cycle is active can also be found in system variable $P_MC ($P_MC = 1 -> a modal subprogram is active).

$C_G60_PROG is only set to 1 if G60 is programmed in an NC block as if G60 were a non-modal effective G function.

Example:

```
N32 G00 X0. Y0. Z0. R0.
N33 G60 X11.8407 Y2.4418              ;$C_G60_PROG = 1, $C_G_PROG = 0, $P_MC = 0
N34 G60 G83 X11.8407 Y2.4418 Z-6.9051 R-5.9 Q0.25F8
                                      ;$C_G60_PROG = 1,
                                      ;$C_G_PROG = 1, $P_MC = 1
N35 G60 X9.3969 Y2.6099               ;$C_G60_PROG = 1, $C_G_PROG = 0, $P_MC = 1
N36 X6.4128 Y2.4511                   ;$C_G60_PROG = 0, $C_G_PROG = 0, $P_MC = 1
N37 G60 X4.0368 Y2.3131               ;$C_G60_PROG = 1, $C_G_PROG = 0, $P_MC = 1
N38 G60 X1.3995 Y2.5461               :$C_G60_PROG = 1, $C_G_PROG = 0, $P_MC = 1
N39 G80                               ;$C_G60_PROG = 0, $C_G_PROG = 0, $P_MC = 0
```

```
cycle383m.spf
PROG CYCLE383M
....
IF $C_G60_PROG == 1
  ;G60 functionality
ENDIF
  ;continue with shell cycle functionality
```

2.2.14 2D/3D rotation G68/G69 (ISO dialect M)

Does not function in SINUMERIK 802D sl.

2D rotation

The coordinate system is rotated around the vertical axis of the activated plane.

Programming

G68 X.. Y.. R..	
X.. Y..:	Coordinates of the pivot point, in relation to the current workpiece zero. If no coordinate is programmed, the pivot point lies in the actual value. The value is always interpreted as absolute.
R:	The angle of rotation, depending on G90/G91, has an absolute or incremental effect. If no angle is programmed, the angle from the setting datum 42150 $SA_DEFAULT_ROT_FACTOR_R is active. G68 must be alone in the block.
G69	Rotation OFF; other commands can be programmed in this block.

G68 is mapped on the channel-specific basic frame 2.
MD28081 $MC_MM_NUM_BASE_FRAMES >= 3 must be set for this.

A programmed angle R is not entered in setting datum 42150 $SA_DEFAULT_ROT_FACTOR_R. This setting datum can only be written by hand and then only takes effect if there is no R programmed in the G68 block.

3D rotation

The G code G68 is extended for 3D rotation.

Programming

G68 X.. Y.. Z.. I.. J.. K.. R..	
X.. Y.. Z..:	Coordinates of the pivot point, in relation to the current workpiece zero. If no coordinate is programmed, the pivot point lies in the workpiece zero. The value is always interpreted as absolute. The coordinates of the pivot point act as a work offset. G90/91 in the block does not affect the G68 command.
I.. J.. K..:	Vector in pivot point. The coordinate system is rotated around this vector at angle R.
R:	Angle of rotation. The angle of rotation always has an absolute effect. If no angle is programmed, the angle from the setting datum 42150 $SA_DEFAULT_ROT_FACTOR_R is active. G68 must be alone in the block.

The 2D or 3D rotation differentiation takes place only through the programming of the vector I, J, K. If there is no vector in the block, G68 2DRot is selected. If there is a vector in the block, G68 3DRot is selected.

If a vector is programmed with the length 0 (I0, Y0, K0), alarm 12560 "Programmed value outside the permissible limits" is triggered.

Two rotations can be switched one after the other with G68. If so far no G68 has been active in a block containing G68, then the rotation is written to the channel-specific basic frame 2. If G68 is already active, the rotation is written to the channel-specific basic frame 3. Thus, both rotations follow one another.

3D rotation is ended with G69. If two rotations are active, both are deselected with G69. G69 must not be alone in the block.

See also

Decoupling frames between Siemens and ISO mode (as of powerline 7.04.02, solution line 1.4) (Page 20)

2.2.15 Double slide or double turret processing G68/G69

Function

Does not function in SINUMERIK 802D sl.

The G68/G69 function can be used to control the processing of rotating parts on both sides. Both processing with a double slide in two channels and processing in one channel with two tools which are permanently linked to one another at a distance x.

MD10812 $MN_EXTERN_DOUBLE_TURRET_ON is used to define whether processing in the two channels is synchronized (= FALSE) or whether the two permanently linked tools are used in turn for processing (= TRUE).

When using permanently linked tools, G68 is used to activate distance x entered in setting datum 42162 $SC_EXTERN_DOUBLE_TURRET_DIST as an additive work offset in the X axis. Because the second tool processes the opposite side of the rotating part, G68 is also

used to activate mirroring around the Z axis (X axis direction change). The work offset and mirroring for the 2nd tool are activated with the next block with axial motion.

G69 is used to reverse the work offset and processing continues with the 1st tool.

G68 and G69 must be programmed in a block on their own.

During tool length compensation in the X axis for the second tool, the correction sign must be taken into account. The sign must be entered as if the X axis were not mirrored. Alternatively the setting data 42900 $SC_MIRROR_TOOL_LENGTH (mirror tool length compensation) and 42190 $SC_MIRROR_TOOL_WEAR (mirror wear values of tool length compensation) must be set.

MD10610 $MN_MIRROR_REF_AX must either be 0 or 1. The X or 1st axis is then always mirrored.

If G68 is programmed and G68 is already active, the G function is skipped. The same applies to G69.

Double turret head: $MN_EXTERN_DOUBLE_TURRET_ON = TRUE

The example below shows processing with two permanently linked tools. Machine datum $MN_EXTERN_DOUBLE_TURRET_ON = TRUE must be set for the function to be effective.

If the setting datum 42162 $SC_EXTERN_DOUBLE_TURRET_DIST = 0, alarm "12728 distance for double turret not set" is output.

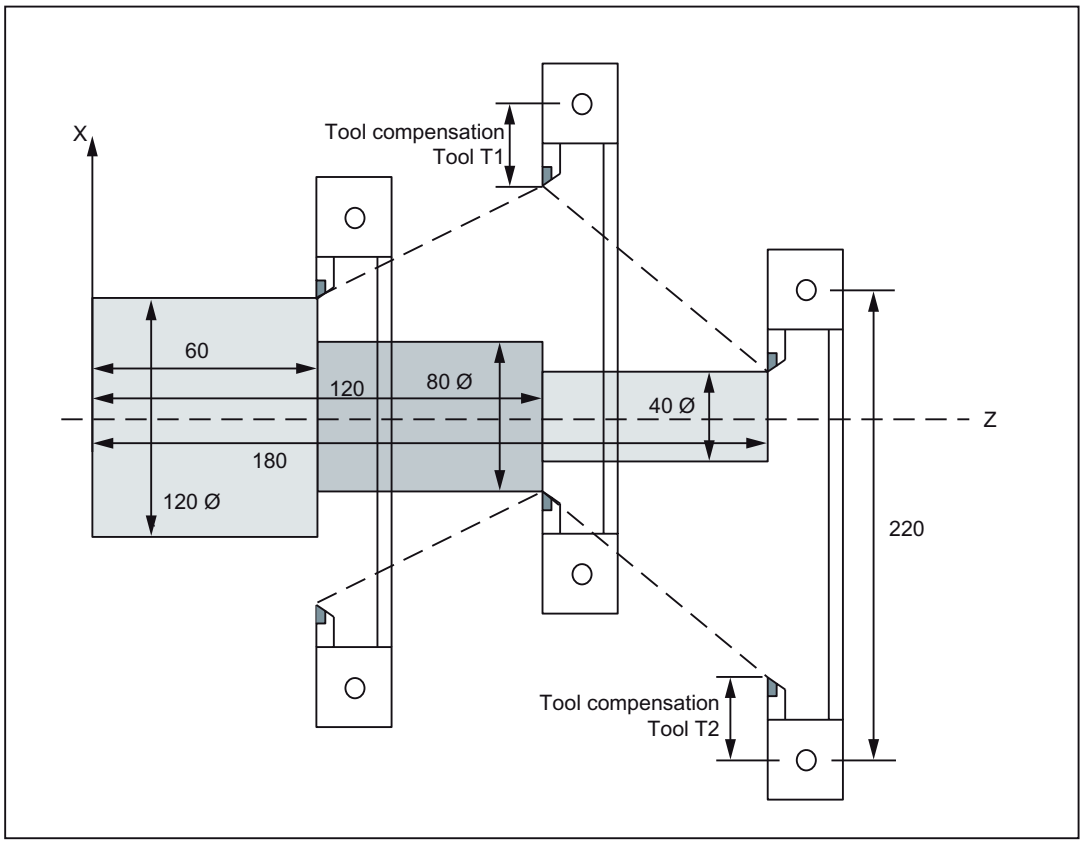


Figure 2-5 Processing with 2 permanently linked tools

Example:

```
N100 X40. Z180. G1 F1 G95 S1000 M3 T1
N110 G68                ;activate mirroring around Z and additive work offset
                        (220mm)
N120 X80. Z120. T2
N130 G69                ;deactivate mirroring and additive work offset
N140 X120. Z60 T1
```

Double slide processing: $MN_EXTERN_DOUBLE_TURRET_ON = FALSE

If MD10812 $MN_EXTERN_DOUBLE_TURRET_ON = FALSE, G68 undertakes channel synchronization. If G68 is programmed in a channel, processing is stopped until G68 is detected in the second channel. This function can be used to synchronize the 1st and 2nd channel. No more synchronization is undertaken. For the two tools to act in a synchronous manner in subsequent processing, the programmed movements and feeds must be the same in the two channels.

Wait mark 1 is used for G68 and wait mark 2 is used for G69 to synchronize the first two channels. The first two M functions must not therefore be used at the same time for channel synchronization in the same part program (see chap. "Program coordination between 2 channels and M commands").

G68 only takes effect in the first two channels. If G68 is programmed in another channel and if MD10812 $MN_EXTERN_DOUBLE_TURRET_ON = FALSE, G68 is skipped.

The function is used for producing thin rotating parts. The two tools should therefore perform the same movement on the respective opposite side of the rotating part, mirrored around the Z axis. The same traversing and feeds must be programmed in the two channels for this to take place.

Example of synchronous processing with two channels:

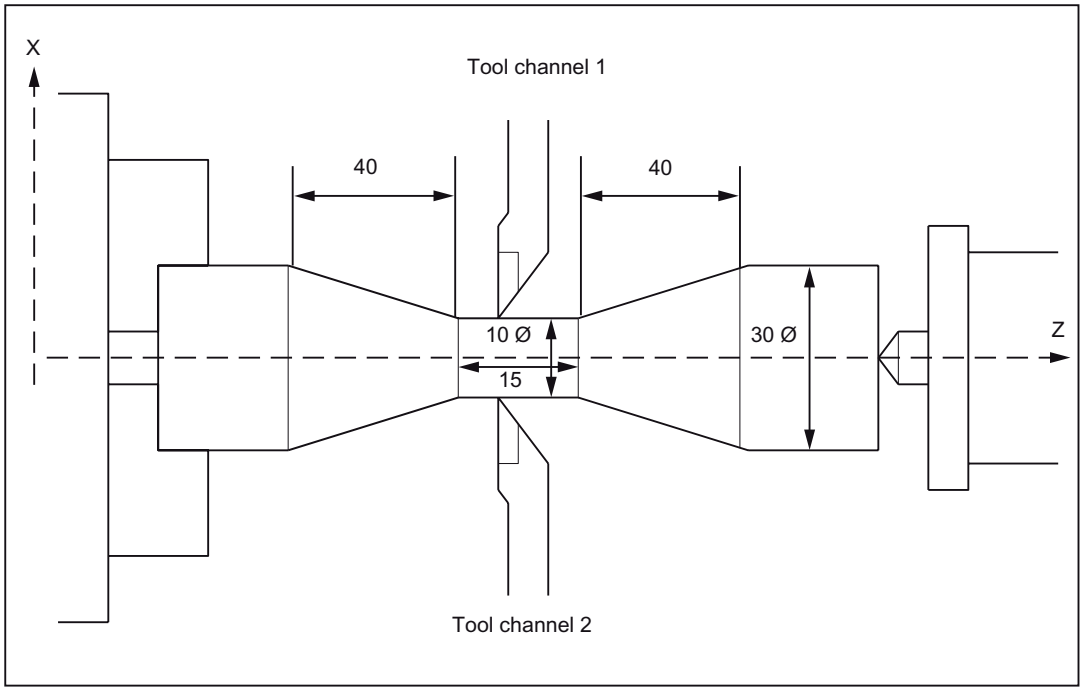


Figure 2-6 Synchronous processing with 2 channels

Example:

Channel 1:

```
N10 ....
- " -
N1000 G68                                    ;start synchronization
N1010 G01 X30 Z120 G95 F1.2 S1000 M3
N1020 X15 Z80
N1030 Z65
N1040 Z25 X40
N1050 G69                                    ;synchronization off
```

Channel 2:

```
N10 .....
- " -
N2000 G68                                    ;start synchronization
N2010 X30 Z120 G01 G95 F1.2 S1000 M3
N2020 X15 Z80
N2030 Z65
N2040 X40 Z25
N2050 G69                                    ;synchronization off
```

In ISO dialect original, channel synchronization is also undertaken when G68 is active.

2.2.16 Polar coordinates G15/G16 (ISO dialect M)

Programming

When in ISO dialect mode, NC program parts in which polar programming is undertaken are started using start command G16. Until the end command G15 is issued, the coordinates of the end points are interpreted as radius and angle polar coordinate values in the current plane.

The first of the plane's axes is interpreted as a pole radius and the second axis as a pole angle, i.e. for G17, X is the radius and Y the angle.

After G16, in each block up to G15 the pole is reset and the pole is reset at G17:

- G90 X: The pole lies at the workpiece zero
- G91 X: The pole lies at the current position
- No X in block: The pole lies at the workpiece zero

If the pole is moved from the current position to the workpiece zero, the radius is calculated as the distance from the current position to the workpiece zero.

Example:

```
G1 F200                      ; Feed
N5 G17 G90 X0 Y0
N10 G16 X100. Y45.           ; Polar coordinates ON, pole is
                             ; workpiece zero, Position X 70,711 Y
                             ; 70,711 in the Cartesian coordinate system
N15 G91 X100 G90 Y0          ; Pole is current position, position X
                             ; 170,711 Y 70,711
N20 Y90.                     ; No X in the block, pole is at
                             ; workpiece zero,
                             ; Radius = SORT(X*X +Y*Y) = 184.776
```

The pole radius is always taken as absolute value, while the pole angle can be interpreted as absolute value as well as incremental value.

Programmed angle

When polar coordinates programming is active, the programmed angle can be read via system variable $P_AP.

This variable is used in the shell cycle. Before the pole is reset, the angle must be saved during incremental programming because the angle is deleted.

Pole programing is ended with G15. The pole radius is set to 0.

2.2.17 Interpolation of polar coordinates G12.1/G13.1 (G112/G113)

Function

With G12.1 and G13.1 an interpolation is activated and deactivated in the machining plane between a rotary axis and a linear axis. A further linear axis may be present perpendicular to this plane. This function corresponds to the TRANSMIT function in Siemens mode.
In Siemens mode, two TRANSMIT transformations may be parameterized. The 1st TRANSMIT data block which must correspond to the 2nd transformation data block is always used for G12.1.

Note

A detailed description of the TRANSMIT function can be found in the NC function description "SINUMERIK 840D, Extended Function", Chapter "Kinematic Transformation (M1)" and in the "Job Planning Programming Manual (PGA)" in Chapter "Transformation".

Example

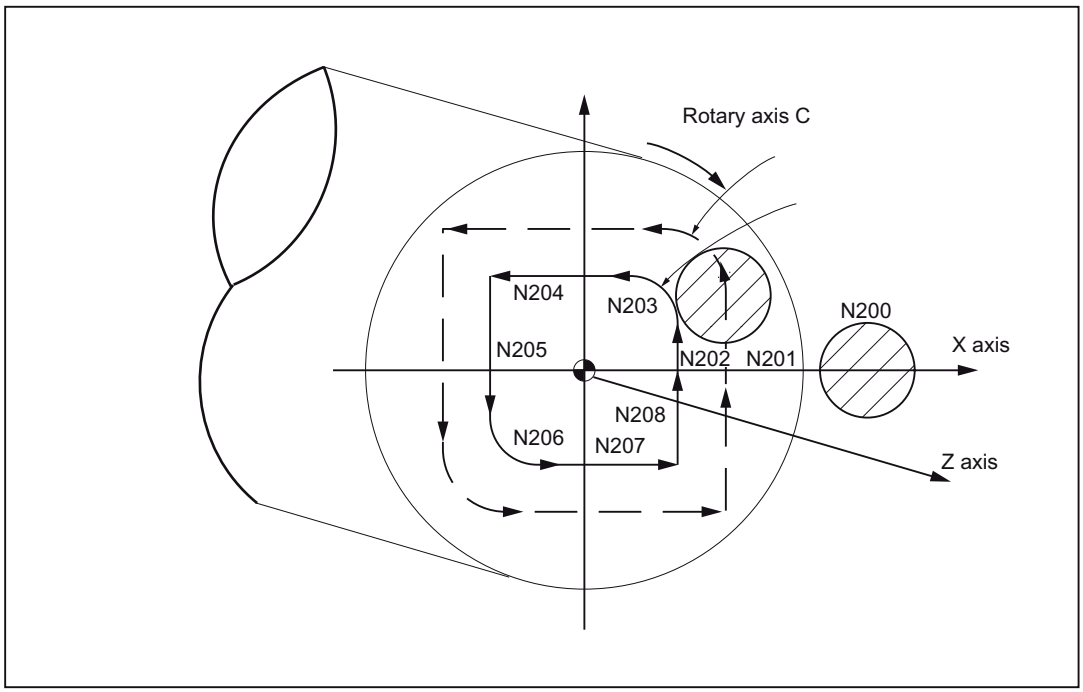


Figure 2-7 Example of the interpolation of polar coordinates

```
00001
N010 T0101
N0100 G90 G00 X60.0 C0 Z..
N0200 G12.1                                    ;TRANSMIT selection
N0201 G42 G01 X20.0 F1000
N0202 C10.0;
N0203 G03 X10.0 C20.0 R10.0
N0204 G01 X-20.0
N0205 C-10.0
N0206 G03 X-10.0 C-20.0 I10.0 J0
N0207 G01 X20.0
N0208 C0
N0209 G40 X60.0
N0210 G13.1                                    ;TRANSMIT deselection
N0300 Z..
N0400 X.. C..
N0900 M30
```

Note

No geo axis interchange (parallel axes with G17 (G18. G19)) should be active.

2.2.18 Cylindrical interpolation G07.1 (G107)

Function

Randomly running grooves can be cut on cylindrical workpieces with function G07.1 (cylindrical interpolation). The path of the grooves is programmed with reference to the unwrapped, level surface of the cylinder. The cylindrical interpolation is started with G07.1 with the specification of the cylinder radius (G07.1 C<cylinder radius>) and ended with G07.1 C0 (radius = 0).

Note

The function is mapped internally on the TRACYL Siemens functionality. In ISO dialect mode, the 1st TRACYL transformation and the 1st transformation data block are always activated with G07.1. The 2nd TRACYL function cannot be activated in ISO dialect mode. A detailed description and parameterization of the 1st TRACYL function can be found in the following documentation:

Description of functions for extended functions, chapter M1 and
Programming Manual Job Planning, chapter 7 "Transformations".

Constraints

For Siemens the rotary axis must be defined for cylindrical interpolation in machine data.

With ISO dialect, the rotary axis is defined for cylindrical interpolation with G07.1 programming <Rotary axis name>....

Example

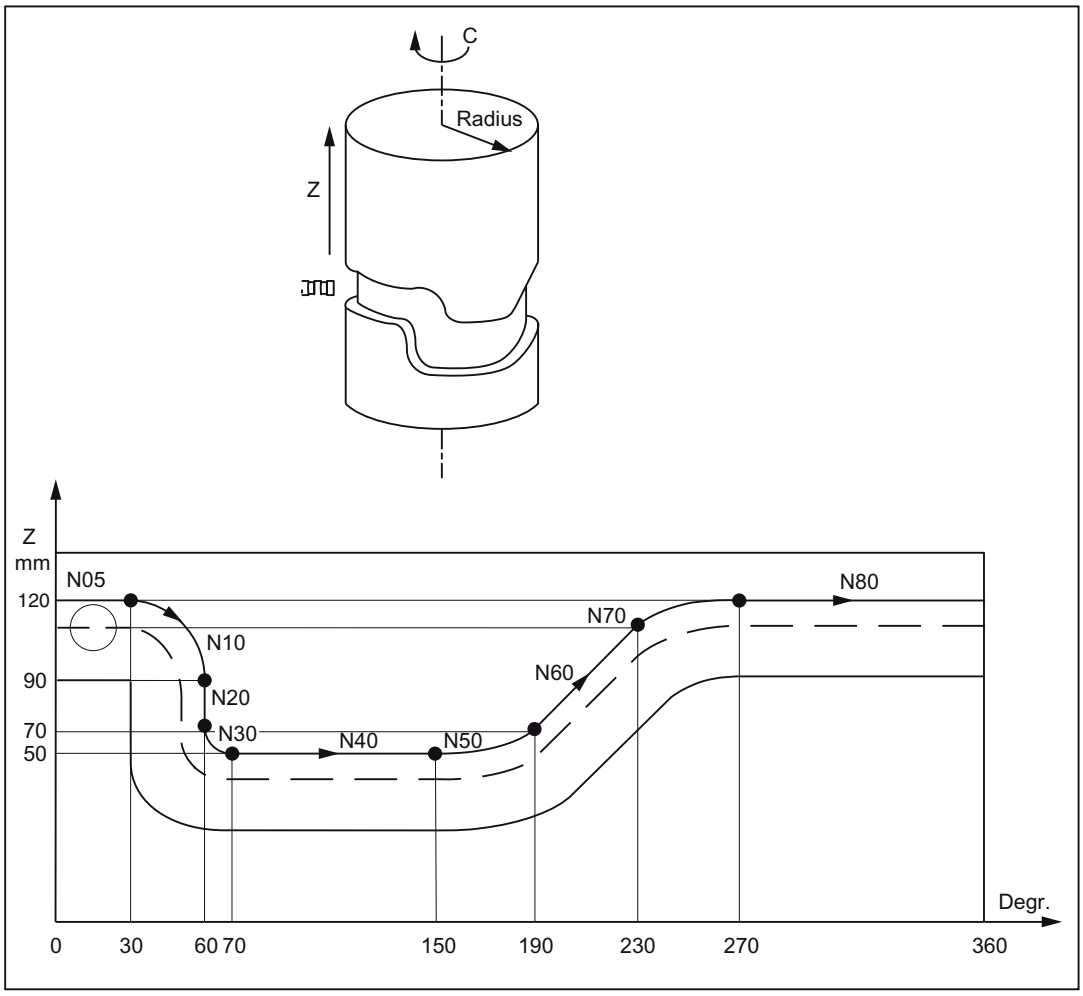


Figure 2-8 Example of cylindrical interpolation G07.1

Example of programming in ISO dialect mode:

```
%0001
N05 G00 G90 Z100.0 C0
N10 G01 G91 G18 Z0 C0
N20 G07.1 C57299                    ;select cylindrical interpolation with radius
                                    57.299 mm
N30 G90 G01 G42 Z120.0 D01 F250
N40 C30.0
N50 G02 Z90.0 C60.0 R30.0
N60 G01 Z70.0
N70 G03 Z60.0 C70.0 R10.0
N80 G01 C150.0
N90 G03 Z70.0 C190.0 R75.0
N100 G01 Z110.0 C230.0
```

```
N110 G02 Z120.0 C270.0 R75.0
N120 G01 C360.0
N130 G40 Z100.0
N140 G07.1 C0                          ;deselect cylindrical interpolation
N150 M30 ;
```

Example of programming in Siemens mode: The Y axis is assigned to the rotary axis as a linear axis.

```
%0001
N05 G00 G90 Z100 C0
N10 G01 G91 G18 Z0 C0;
N20 TRACYL(114.598)                    ;select cylindrical interpolation with radius
                                       57.299 mm
N30 G90 G01 G42 Z120 D01 F250
N40 Y30
N50 G02 Z90 Y60 RND=30
N60 G01 Z70
N70 G03 Z60.0 Y70 RND=10
N80 G01 Y150
N90 G03 Z70 Y190 RND=75
N100 G01 Z110 Y230
N110 G02 Z120 Y270 RND=75
N120 G01 Y360
N130 G40 Z100
N140 TRAFOOF                           ;deselect cylindrical interpolation
N150 M30 ;
```

2.2.19 Interrupt program with M96/M97 (ASUB)

M96

A subprogram can be defined as an interrupt routine with the M96 P<Program No.>.

The start of this program is triggered by an external signal. To start the interrupt routine, the 1st rapid NC input is used from among the eight inputs available in the Siemens mode. Another rapid input (1 to 8) can also be selected with MD10818 $MN_EXTERN_INTERRUPT_NUM_ASUP.

The function is mapped on the Siemens syntax SETINT(x) <CYCLE396> [PRIO=1].

The interrupt program programmed with Pxxxx is called in shell cycle CYCLE396 in ISO mode. The program number can be found in $C_PI. At the end of the shell cycle, MD10808 $MN_EXTERN_INTERRUPT_BITS_M96, bit 1 is evaluated and either positioned on the interruption point with REPOS or continued with the next block. The value programmed with "P" can be found in the new cycle variable $C_PI without a leading zero. This must be increased to four digits in the shell cycle before the subprogram is called.

Example:

N0020 M96 P5
Call in shell cycle
progName = "000" << $C_PI
ISOCALLprogName

See also how to handle 8-digit program numbers if MD20734 $MC_EXTERN_FUNCTION_MASK, bit 6 is set.

End of interruption (M97)

The interrupt program is deactivated with M97. Only after the next activation with M96 can the interrupt routine be started with the external signal.

This corresponds to the Siemens syntax ENABLE(x).

x = Content of MD10818 $MN_EXTERN_INTERRUPT_NUM_ASUP

If the interrupt program programmed with M96 Pxx is to be called directly with the interrupt signal (without intermediate step with CYCLE396), then machine datum 20734 $MC_EXTERN_FUNCTION_MASK, bit 10 must be set. The subprogram programmed with Pxx is then called in Siemens mode during a signal change from 0 -> 1.

The M function numbers for the interrupt function are set through machine data. MD10804 $MN_EXTERN_M_NO_SET_INT is used to determine the M number for activating an interrupt routine, MD10806 $MN_EXTERN_M_NO_DISABLE_INT is used to determine the M number for suppressing an interrupt routine.

Only M functions which are not standard M functions may be set. The default of the M functions is M96 and M97. To activate the function, bit 0 must be set in MD10808 $MN_EXTERN_INTERRUPT_BITS_M96. The M functions are not output to the PLC. The M functions are interpreted as normal auxiliary functions if bit 0 is not set.

At the end of the "interrupt" program, one normally traverses to the end position of the part program block following the interruption block. If the part program is to be processed further from the interruption point, there must be a REPOS instruction at the end of the "interrupt" program, e.g. REPOSA. For this, the interrupt program must be written in the Siemens mode.

The M functions for activating and deactivating an interrupt program must be present alone in the block. The system issues alarm 12080 "Channel %1 block %2 syntax error for text %3" if addresses other than "M" and "P" are programmed in the block.

Information about machining cycles

In ISO dialect original you can set whether a machining cycle is to be interrupted immediately or only at the end using an interrupt routine. To do this, the shell cycles must evaluate MD10808 $MN_INTERRUPT_BITS_M96 bit 3. If bit=1, the interrupt must be locked at the start of the cycle with DISABLE(1) and activated again at the end of the cycle with ENABLE(1) so that the machining cycle is not interrupted.

Because the interrupt program is only started during edge change 0/1, the interrupt input must be monitored in the event of a locked interrupt during the cycle runtime with a synchronized action in the shell cycle. If the interrupt signal in the cycle is changed from 0 to 1, the interrupt signal must be set again following ENABLE(1) at the end of the shell cycle so that the interrupt program is then started. To be able to write the interrupt input in the shell cycle, MD10361 $MN_FASTIO_DIG_SHORT_CIRCUIT[1] must be parameterized.

Machine data

The response of the interrupt program function can be determined from the following machine data:

MD10808 $MN_EXTERN_INTERRUPT_BITS_M96:
Bit 0 = 0
Interrupt program is not possible as M96/M97 are normal M functions.
Bit 0 = 1
Activation of an interrupt program with M96/M97 is allowed.

Bit 1= 0
The part program is further processed with the end position of the next block following the interrupt block (REPOSL RME)
Bit 1= 1
Continue processing part program from interrupt position
(Evaluation in interrupt program (ASUB), return with/without REPOSL)

Bit 2 = 0
The interrupt signal interrupts the current block immediately and starts the interrupt routine
Bit 2 = 1: The interrupt routine is started only at the end of the block.

Bit 3 = 0
The machining cycle is interrupted immediately after an interrupt signal arrives.
Bit 3 = 1
The interrupt program is started only at the end of the machining cycle
(evaluation in the shell cycles)

Bit 3 must be evaluated in the shell cycles and the cycle process must be adapted accordingly.

Bit 1 must be evaluated in the interrupt program.

If Bit 1 = TRUE, REPOSL RMI must be used for positioning on the interruption point at the end of the program, otherwise REPOSL RME must be used for positioning on the block end position.

Example:

```
N1000 M96 P1234          ;activate ASUB 1234.spf. In the case of a rising edge of
                         ;the 1st rapid input, the program
                         ;1234.spf is started.
N3000 M97                ;Deactivation of ASUB
```

Before the call of the interrupt program no rapid lift (LIFTFAST) is performed. With the increasing edge of the interrupt signal, depending on MD10808 $MN_EXTERN_INTERRUPT_BITS_M96, the interrupt program is started immediately.

Siemens constraints

The interrupt routine is treated as a normal subprogram. In other words, to be able to execute interrupt routines, at least one subprogram level must be free. (For Siemens there are 12 program levels, for ISO dialect there are 5.)

The interrupt routine is started only during an edge change of the interrupt signal from 0 to 1. If the interrupt signal remains permanently on 1, then the interrupt program is not restarted any more

ISO dialect constraints

A program level is reserved for the interrupt routine such that all permissible program levels may be filled before the interrupt program is called.

Depending on the machine data, the interrupt program is also started when there is an static signal.

2.2.20 Comments

In ISO dialect mode, round brackets are interpreted as comment signs. In Siemens mode, ";" is interpreted as comment. To simplify matters, an ";" is also understood as a comment in ISO dialect mode.

If the comment start sign '(' is used inside a comment again, the comment is ended only if all the open brackets are closed again.

Example:

```
N5 (comment) X100 Y100
N10 (comment(comment)) X100 Y100
N15 (comment(comment) X100) Y100
```

X100 Y100 is executed in block N5 and N10, but only Y100 in block N15, because the first bracket is closed only after X100. Everything up to that point is interpreted as a comment.

2.2.21 Skip block

The sign for skipping or suppression of blocks "/" can be used at any convenient position in a block, i.e. even in the middle of the block. If the programmed block skip plane is active on the date of the compilation, the block is not compiled from this point up to the end of the block. An active block skip plane has the same effect as a block end.

Example:

N5 G00 X100. /3 YY100 --> Alarm 12080,
N5 G00 X100. /3 YY100 --> no alarm, if block skip plane 3 is active

Block skip signs within a comment are not interpreted as block skip signs

Example:

```
N5 G00 X100. ( /3 Part1 ) Y100       ;the Y axis is traversed even when the
                                     ;block skip plane 3 is active
```

The block skip planes /1 to /9 can be active. Block skip values <1 >9 lead to alarm 14060 "Channel %1 block %2 Impermissible skip plane for differential block skip".

The function is mapped to the existing Siemens skip planes. Unlike ISO Dialect original, / and /1 are separate skip planes that must also be activated separately.

2.2.22 Auxiliary function output

M functions

ISO dialect mode

M functions are output to the PLC as auxiliary functions. The only exceptions are M98 and M99. Predefined M functions are:

M17, M40, M41, M42, M43, M44, M45, M70, M96, M97, M98, M99.

Spindle axis switchover with M29

In ISO dialect mode, the spindle is switched to axis mode with M29. The M function number may however also be set differently using machine datum.

MD20095 $MC_EXTERN_RIGID_TAPPING_M_NR is used to pre-set the M function number. The machine datum is only effective in external language mode and is preset with M29. Only the M function numbers that are not used as standard M functions can be assigned. For example, the M function numbers M0-M5, M30, M98, M99 are not allowed.

The same function is executed in Siemens mode with M70.

MD20094 $MC_SPIND_RIGID_TAPPING_M_NR) is used to pre-set the M function number. The machine datum is only effective in Siemens mode and is preset with M70. An M function other than M70 can therefore also be set in Siemens mode for the spindle changeover. The machine datum may only be assigned M function numbers that are not used as standard M functions. M0 to M5, M17, M19, M30, M40 to M45 are not permitted.

H functions

All H functions are output to the PLC in ISO dialect M as auxiliary functions. With ISO dialect T G Code System A, H is the incremental path of the 4th axis - only if a 4th axis is present.

T functions

T functions are output to the PLC as auxiliary functions. T also means tool selection.

D functions

The D function is output to the PLC as an auxiliary function. With ISO dialect M, the tool length compensation is activated under address D.

B functions

If B is not an axis, the B function is output to the PLC as auxiliary function H with address extension H1=.

Example: B1234 is output as H1 = 1234.

2.2.23 Approach 1st home position with intermediate point (G28)

The CYCLE328 cycle is called automatically when reading the ISO dialect command "G28 <axis>". The intermediate position (incremental or absolute) via which the home position is to be approached is stated under <Axis>. The intermediate position and reference position are approached in positioning mode.

The cycle only applies for the axes available with ISO dialect:

- ISO dialect M: X, Y, Z (A, B, C, U, V, W)
- ISO dialect T: X, Z, Y (C)

The cycle is always run with radius programming (DIAMOF). Active G commands become effective again once the cycle is complete and before the cycle is called.

Various machine data must be set before the 1st home position is approached, see "Commissioning" chap.

2.2.24 Switching precontrol on/off with G08 P..

Function

Does not function in SINUMERIK 802D sl.

The precontrol reduces the velocity-dependent overtravel when contouring towards zero. Traversing with precontrol permits higher path accuracy and thus improved machining results.

Note

The type of precontrol and which path axes are to be traversed with precontrol is specified via machine data.

Default: Velocity-dependent precontrol
Option: Acceleration-dependent precontrol

Example

```
N0010 G08 P1                              ;Switch on precontrol
N0020 G1 X10 Y50 F900
N0030 G1 X20 Y70
N1000 G08 P0                              ;Switch off precontrol
```

If G08 is programmed without "P", alarm 12470 "Channel %1 block %2 G function %3 is unknown" is output.

In order to use G08 P1 to flexibly activate other functions such as SOFT, BRISK etc., G08 P.. is used to call cycle CYCLE308.spf.

G08 P1 alone must remain in the block.

2.2.25 Compressor in ISO dialect mode

The commands COMPON, COMPCURV, COMPCAD are commands of the Siemens language and they activate a compressor function that combines several linear blocks into one machining section. If this function is activated in Siemens mode, even linear blocks can then be compressed in ISO mode with this function.

The blocks can at the most consist of the following commands:

- Block number
- G01, modal or in block
- Axis assignments
- Feedrate
- Comments

If a block contains other commands (e.g., auxiliary functions, other G codes, etc.), then compression does not take place.

Value assignments with $x for G, axes and feedrate are possible, as is the skip function.

Example: These blocks are compressed:

```
N5 G290
N10 COMPON
N15 G291
```

```
N20 G01 X100. Y100. F1000
N25 X100 Y100 F$3
N30 X$3 /1 Y100
N35 X100 (Axis 1)
```

These blocks are **not** compressed:

```
N5 G290
N10 COMPON
N20 G291
N25 G01 X100 G17                    ;G17
N30 X100 M22                        ;Auxiliary function in block
N35 X100 S200                       ;Spindle speed in block
```

2.2.26 Automatic corner override G62

An inner corner with active tool radius compensation is often meaningful to reduce the feedrate.

G62 operates only on inner corners with active tool radius compensation and active continuous-path mode. Only the corners whose inner angle is smaller than SD42526 $SC_CORNER_SLOWDOWN_CRIT are taken into account. The inner angle is defined from the bend in the contour.

The feedrate is reduced by the factor SD42524 $SC_CORNER_SLOWDOWN_OVR:

Traversed feedrate =

F * $SC_CORNER_SLOWDOWN_OVR * feedrate override.

The feedrate override is made up of the feedrate override of the Machine Control Panel multiplied by the override from synchronized actions.

The reduction in feedrate is begun at a distance of SD42520 $SC_CORNER_SLOWDOWN_START before the corner. It ends at distance SD42522 $SC_CORNER_SLOWDOWN_END after the corner (see following figure). An appropriate path is used for curved contours.

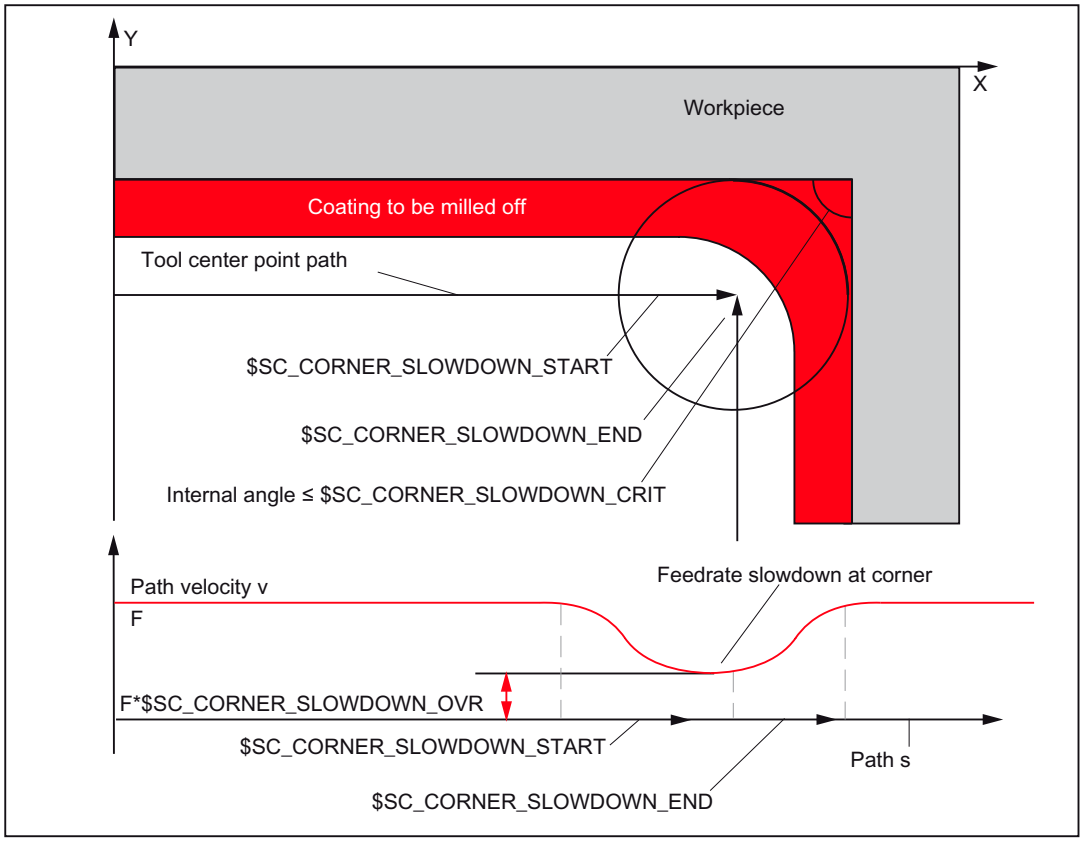


Figure 2-9 Parameter assignment of feedrate reduction G62 with the example of a 90 degree corner

Parameter assignment

The override value is set using the following setting data:

SD42520 $SC_CORNER_SLOWDOWN_START
SD42522 $SC_CORNER_SLOWDOWN_END
SD42524 $SC_CORNER_SLOWDOWN_OVR
SD42526 $SC_CORNER_SLOWDOWN_CRIT

The setting data is preassigned with the value 0.

- If $SC_CORNER_SLOWDOWN_CRIT = 0, the corner deceleration is effective only at the reversal points.
- If $SC_CORNER_SLOWDOWN_START and $SC_CORNER_SLOWDOWN_END are equal to 0, then the feedrate reduction is approached with the permissible dynamic response.
- If $SC_CORNER_SLOWDOWN_OVR = 0, then a transient stop is inserted.
- $SC_CORNER_SLOWDOWN_CRIT is related to the geometry axes in G62. It defines the maximum inner angle in the current machining plane up to which the corner deceleration is used. G62 is not effective in rapid traverse.

Activating

The function is activated via G62 and/or G621. The G code is active either via the corresponding part program command or through MD20150 $MC_GCODE_RESET_VALUES[56].

Examples

```
$TC_DP1[1,1]=120
$TC_DP3[1,1]=0.                          ;Tool length compensation
$TC_DP4[1,1]=0.
$TC_DP5[1,1]=0.
N1000 G0 X0 Y0 Z0 F5000 G64 SOFT
N1010 STOPRE
N1020 $SC_CORNER_SLOWDOWN_START = 5.
N1030 $SC_CORNER_SLOWDOWN_END = 8.
N1040 $SC_CORNER_SLOWDOWN_OVR = 20.
N1050 $SC_CORNER_SLOWDOWN_CRIT = 100.
N2010 X00 Y30 G90 T1 D1 G64
N2020 X40 Y0 G62 G41                     ;Inner corner of N2030,
                                         ;but TRC still selected
N2030 X80 Y30                            ;Inner corner of N2040 127 degrees
N2040 Y70                                ;Inner corner of N2050 53 degrees
N2050 X40 Y40                            ;Outer corner of N2060
N2060 X20 Y70                            ;Inner corner of N2070 97 degrees
N2070 Y60                                ;Inner corner of N2080 90 degrees
N2080 X20 Y20                            ;Outer corner of N2090,
                                         ;irrelevant due to TRC deselection
N2090 X00 Y00 G40 FENDNORM
M30
```

2.3 Substitution by a substitution cycle with a tool selection block

2.3.1 Milling

Note

The following generally applies to all substitution cycles in which the programmed values are transferred in $C_ variables:

The $C_ system variables must be copied at the start of the cycle into R parameters, local and global user data. The cycle then only works with the copies.

Substitution by an M macro

MD10814: $MN_EXTERN_M_NO_MAC_CYCLE[0] = 6
MD10815: $MN_EXTERN_M_NO_MAC_CYCLE_NAME[0] = "L6"

Nothing from this block is executed, all programmed parameters are copied into $C_ system variables.

In the cycle, T, H, D and M must be programmed and all other addresses programmed in the block written indirectly.

Example:

MD22550: $MC_TOOL_CHANGE_MODE = 1
MD22560: $MC_TOOL_CHANGE_M_CODE = 206

N5 T10 H22 M6 or N5 T10 D33 M6 ; M6 calls L6

N100 PROC L6( )

N105

N110 $C_MACPAR[1]=$C_T

N115 $C_MACPAR[2]=$C_H

N120 $C_MACPAR[3]=$C_D

N125 G291

N130 T$1 H$2 M206 or N130 T$1 D$2 M206

N135 G290

N140 RET

T can also be programmed in Siemens mode with T=$C_T.

Substitution by an M function

MD10715: $MN_M_FCT_CYCLE[0] = 6
MD10716: $MN_M_FCT_CYCLE_NAME[0] = "L6"
MD10718: $MN_M_NO_FCT_CYCLE_PAR = 0
MD10719: $MN_T_NO_FCT_CYCLE_MODE

MD10718 is used to parameterize whether the cycle call takes place when the parameters are transferred. MD10719 is used to set the call time at the start or end of the block.

If just **N5 T M6** and not H D is programmed in the part program block, the cycle can be called without the transfer of parameters. The block is executed and the cycle called without the transfer of parameters at the end of the block.

Only the M function has to be programmed in the cycle to activate the tool.

Example:

MD22550: $MC_TOOL_CHANGE_MODE = 1
MD22560: $MC_TOOL_CHANGE_M_CODE = 206
MD10715: $MN_M_FCT_CYCLE[0] = 6
MD10716: $MN_M_FCT_CYCLE_NAME[0] = "L6"
MD10718: $MN_M_NO_FCT_CYCLE_PAR = -1

N5 T10 M6 ; M6 calls L6

N100 PROC L6( )

…

…

N110 m206

N115 RET

If **N5 T H M6** or **N5 T D M6** is programmed in the part program block, the cycle must be called with the transfer of parameters. T H D and the M function then have to be programmed in the cycle to activate the tool. H and D must be programmed after the T and M function to activate the tool.

Example:

MD22550: $MC_TOOL_CHANGE_MODE = 1
MD22560: $MC_TOOL_CHANGE_M_CODE = 206
MD10715: $MN_M_FCT_CYCLE[0] = 6
MD10716: $MN_M_FCT_CYCLE_NAME[0] = "L6"
MD10718: $MN_M_NO_FCT_CYCLE_PAR = 0

N5 T10 H22 D23 M6 ; M6 calls L6

N100 PROC L6( )

N105 IF $C_T_PROG == 1

N110 $C_MACPAR[1]=$C_T

N115 G291

N120 T$1 M206

N125 G290

or

N110; programming of H and D

; indirectly via $C_MACPAR as in block N110 and N120

M115 M17

Substitution by T programming

MD10717: $MN_T_FCT_CYCLE_NAME="L6"
$MN_T_NO_FCT_MODE
MD10719: $MN_T_NO_FCT_CYCLE_MODE

Nothing from this block is executed, all programmed values are written into $C_ system variables. The call time is determined with $MN_T_NO_FCT_MODE. T and M must be programmed in the cycle. If H or D are programmed in addition to T in the call block, H and D must be programmed in the cycle after the T and M function to activate the tool.

Example:

MD22550: $MC_TOOL_CHANGE_MODE = 1
MD22560: $MC_TOOL_CHANGE_M_CODE = 206

N5 T10 ; T calls L6.spf

N100 PROC L6( )

N105 T=$C_T M206

or in ISO mode indirectly via T$1

N110 $C_MACPAR[1]=$C_T

N120 G291

N125 T$1 M206

N125 G290

2.3.2 Turning

Substitution by an M macro

MD10814: $MN_EXTERN_M_NO_MAC_CYCLE[0] = 6
MD10815: $MN_EXTERN_M_NO_MAC_CYCLE_NAME[0] = "L6"

Nothing from this block is executed, all programmed parameters are written into $C_ system variables.

T must be programmed in the cycle. The programmed T contains the tool number and the correction number. The programmed value is transferred in $C_T. T1234 results in $C_T = 1234; $C_T_PROG = 1.

Example:

MD22550: $MC_TOOL_CHANGE_MODE = 1
MD22560: $MC_TOOL_CHANGE_M_CODE = 206

N5 T1022 M6 ; M6 calls L6

N100 PROC L6( )

N101 IF $C_T == TRUE

N110 $C_MACPAR[1]=$C_T

N120 G291

N125 T$1 M206

N130 G290

N135 ENDIF

N140 M17

Substitution by an M function

MD10715: $MN_M_FCT_CYCLE[0] = 6
MD10716: $MN_M_FCT_CYCLE_NAME[0] = "L6"

The block is executed and the cycle called without the transfer of parameters at the end of the block.

The M function is programmed in the cycle at the end to activate the tool (if present).

Example:

MD22550: $MC_TOOL_CHANGE_MODE = 1

MD22560: $MC_TOOL_CHANGE_M_CODE = 206

N5 T1234 M6 ;M6 calls L6

PROC L6( )

…

M206

M17

Substitution by T programming

MD10717: $MN_T_FCT_CYCLE_NAME="L6"

Nothing from the block is executed, all programmed values are written into $C_ system variables.

The call time is determined with $MN_T_NO_FCT_CYCLE_MODE. T and M must be programmed in the cycle. The programmed T value contains the tool number and tool compensation number.

The split T value and the tool number in $C_T and the programmed tool number in $C_H are transferred to the cycle according to MN_EXTERN_DIGITS_TOOL_NO or MN_EXTER_DIGITS_OFFSET_NO.

The unsplit programmed T value is also transferred in $C_T_VALUE.

Example:

Tool	Cutting edge	H number
T10	D1	H1
	D2	H2
T31	D1	H3
	D2	H4

MN_EXTER_DIGITS_OFFSET_NO = 2

N5 T3104 ; tool 31 $C_T == 31

; H number 4$C_H == 4

; $C_T_VALUE == 3104

T is programmed indirectly in the cycle with $C_T_WORD.

Example:

N5 T3104 ; T calls L6.spf

PROC L6( ) ; T indirectly in ISO mode

N100

N102 $C_MACPAR[1] = $C_T_VALUE

N105 G291

N110 T$1

N115 G290

N120 M17

2.3.3 Indirect programming in ISO mode using $ variables

What are known as $ variables exist in order to perform indirect programming in ISO mode. Values are assigned in ISO mode via these $ variables, for example T$1. In total there are 30 $ variables, $1 to $30.

The $ variables are written in Siemens mode using $C_MACPAR[0] – [30]. When programming in ISO mode, the value is read from the corresponding $C_MACPAR[ ] variable and assigned to the address. The integer value following $ corresponds to the index for $C_MACPAR[ ].

Example:

N5 G290
N10 $C_MACPAR[5] = 12
N15 G291
N20 T$5

The value from $C_MACPAR[5] is assigned to address T. This corresponds to T12 in ISO mode.

Several $ assignments can be located in the same block.

N5 G290
N10 $C_MACPAR[1] = 1000 $C_MACPAR[2] = 85 $C_MACPAR[3] = 93.2
N15 G29
N20 F$1 X$2 Y$3
This corresponds to F1000 X85 Y93.2

Numerous calculations can therefore be undertaken in Siemens mode and the results then assigned to addresses in ISO mode.

Note

Pure calculations in ISO mode e.g.: N5 $1=$2+1200 are not possible.

2.4 Subprogram and macro technology

2.4.1 Subprogram technique: M98

Subprogram call

In ISO dialect, subprogram calls with M98 are programmed.

For the program syntax, see the figure below:

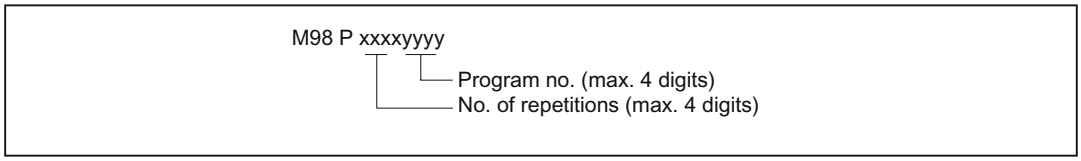


Figure 2-10 Description of permissible parameters

Program syntax M98 Pxxxxyyyy is used to call a subprogram with the number yyyy and repeat it xxxx times. If xxxx is not programmed, the subprogram is only executed once. The subprogram name always comprises 4 digits or is extended by adding 0s until there are 4 digits.

For example, if M98 P21 is programmed, a search is undertaken for the 0021.spf program name in the part program memory and the subprogram is run once. If the subprogram is to be run 3 times, M98 P30021 should be programmed.

To date the number of program passes (number of repeats) in ISO dialect M/T has been programmed with the subprogram number under address "P".

As an alternative to this programming syntax, the number of subprogram passes can now also be programmed under address "L". The subprogram number is still programmed with Pxxxx. If the number of passes is programmed with both addresses, the number of passes programmed with address "L" applies. The number of subprogram passes may be between 1 and 9999.

Example:

```
N20 M98 P20123              ;the 123.spf subprogram is executed twice
N40 M98 P55 L4              ;the 55.spf subprogram has been executed four times
N60 M98 P30077 L2           ;the subprogram 77.spf is executed twice.
                            ;The number of passes programmed under address "P" =3
                            ;is ignored.
```

End subprogram

The subprogram is ended with M99.

If M99 Pxxxx is programmed, a move is made to block number Nxxxx when returning to the main program. The block number must always start with "N". The block number is first looked for in a forward direction (from subprogram call working towards program end). If no suitable block number is found, the part program is eventually searched in the reverse direction (in the direction of the start of the part program).

If M99 has no block number (Pxxxx) in a subprogram, the subprogram is ended and a jump made to the block after the subprogram call in the main program.

If M99 is without a block number (Pxxxx) in a main program, the control goes to the start of the main program and the main program is processed afresh.

These M commands are not output to the PLC.

Subprogram return with "RET"

Applies to ISO dialect T only.

After scrubbing, in the Siemens shell cycles for stock removal (as in ISO dialect) the program should continue in the main program following the contour description. To do this, the shell cycle must return to the block after the end of the contour description in the subprogram. In order to jump the blocks with the contour description during stock removal cycles after the subprogram call (with G71-G73), two optional parameters are added to the RET command.

Program processing in the program being called (main program) with the block <block number/label> is continued with the RET command (STRING <block number/label>).

If program processing is to be continued with the next block after <block number/label>, the 2nd parameter in the RET command must be programmed > 0 RET (<block number/label>, 1). If a value > 1 is programmed for the 2nd value, the subprogram also returns to the block after the block with <block number/label>.

The contour to be processed is saved in the main program for cycles G70-G73. The extended RET command is needed to start at the end of G70 (finishing cut above contour with stock removal cycle) in the main program after the contour description. To jump to the next NC block after the contour description at the end of the shell cycle for G70, this must end with the following return syntax:

RET ("N" << $C_Q, 1)

Search direction:

The search direction for <block number/label> is always firstly forward direction (heading towards program end) and then reverse direction (heading towards program start).

Example

```
N10 X10. Y20.
N20 G71 P30 Q60 U1 W1 F1000 S1500
       N10 ...                                ;shell cycle for stock removal cycle
       N20 DEF STRING[6]BACK
       N30 ...
       N90
       N100 RET ("N"<<$C_Q, 1)                ;jump back to block after
                                              ;contour description -> N70
```

```
N30 X50. Z20.
N40 X60.
N50 Z55.
N60 X100. Z70.
N70 G70 P30 Q60
N80 G0 X150. Z200.
N90 M30
```

Note

In Siemens mode, M30 is interpreted in the subprogram as a program return jump.

In ISO dialect mode, M30 is also interpreted in the subprogram as part program/end.

2.4.2 Siemens language commands in ISO dialect mode

Programming

Certain Siemens language commands are also needed in ISO dialect mode for Shopmill. These are then run in ISO dialect mode. These language commands include subprogram calls with and without the transfer of parameters (not calls with Lxx because address L already has a different meaning with ISO dialect), program part repeat and control structures. All other Siemens language commands are rejected with an alarm in ISO dialect mode.

When ISO dialect mode is active, the following Siemens language commands may be programmed:

REPEAT:

REPEAT	Block number > [<block number>] [P..]
REPEAT	UNTIL
REPEATB	<block number> [P..]

Only block numbers and not labels are permitted as start and end delimiters.

IF - ELSE - ENDIF

FOR - ENDFOR

WHILE - ENDWHILE

IF<condition> **- GOTO F**<condition>

CASE

Modal and non-modal subprogram calls

```
N100 CALL "SHAFT" or
N100 MCALL "SHAFT" or
N100 SHAFT
```

Modal and non-modal subprogram calls with transfer of parameters

```
N100 MCALL SHAFT ("ABC"; 33.5) or
N100 SHAFT ("ABC"; 33.5) subprogram calls with path details
N100 CALL "/_N_SPF_DIR/SHAFT or
N100 MCALL "/_N_SPF_DIR/SHAFT or
N100 PCALL /_N_SPF_DIR/SHAFT
```

2.4.3 Expansion of subprogram call for contour preparation with CONTPRON

Expansion

With ISO dialect the contour description for the stock removal cycles G70-G73 is not saved separately in a subprogram (as with SINUMERIK), but in the part program (main program). When calling the cycles, the range of the contour description is defined with a start and end block number. The cycles contain these block numbers as transfer parameters. The indirect subprogram call is expanded for the Siemens adjustment cycles.

Until now a subprogram call has been called indirectly with CALL <program name>.

The indirect subprogram call is expanded as follows for accessing the contour description in the main program:

CALL [<program name>] BLOCK <start label> TO <end label>

If there is no program name stated or if an empty string is stated as the program name, i.e. CALL BLOCK <Start label> TO <End label>, the program part (start/end label) is sought in the program currently selected. The labels are also sought in the selected program for MDA, ASUB etc. (e.g. in the case of MDA, labels are not sought in the MDA buffer but in the program with the selected program name). If this syntax is written directly in a main program, it acts like a program part repeat with REPEAT <Start label> <End label> with a loop pass, i.e. start and end label are sought in the same program, in which the CALL BLOCK ... command is also programmed.

If a program name is stated, i.e. CALL <progName> BLOCK <Start label> TO <End label>, the program part (start/end label) is sought in the "progName" subprogram.

Example

```
Nxx G71 Pxx Q1110 U.. W..    ;ISO dialect G function calls shell cycle
                             ;CYCLE395.spf
                ;_N_CYCLE395_SPF
                N10 .......
                .......
                Nxxx CYCLE95(....., "N"<<$C_P, "N"<<$C_Q)
                             ;stock removal cycle with additional
                             parameters
                             ;for start and end label
                PROC CYCLE95(....., STRING[20] start lab, STRING[20]
                             end lab)
                N10 ........
                .........
                Nxxx CONTPRON(...)
                N.... CALL "" BLOCK start lab TO end lab
                             ;read contour description or
                N.... CALL BLOCK start lab TO end lab
                             ;call contour program
                EXECUTE(...)
                ........
                Nxx M17
Nxxx .....
Nxxx RET ("N"<<$C_Q, 1)      ;return to next block after
                             ;contour description
N1120 ....
Nxxx M30
```

Note

CONTPRON and EXECUTE calls themselves must not be changed.

Searching for start block number

Does not function in SINUMERIK 802D sl.

The search for the start block number (start label) of the contour description always takes place first working towards the program end (forwards) and then working towards the program start (backwards).

If the same block number is programmed several times, the next block number (label) after the current block in the program containing the contour description is recognized as the start of the contour description (see example). The current block is usually the block in which the stock removal cycle (shell cycle) was called in the main program.

Example:

In stock removal cycle CYCLE395, the contour description found in the main program between blocks N10–N30 is to be used (with CALL BLOCK N10 TO N30 in CYCLE395). N40 is the current program line in the main program.

The contour description block in our example is shown in **bold**.

```
N5 G1 F500
N10 X10. Y20.
N20 X30.
N30 Y10.
N40 G71 P10 Q30...              ;call shell cycle for stock removal cycle
...                             ;(In the stock removal cycle,
...                             ;"CALL BLOCK N10 TO N30" is programmed)
...                             ;the bold lines are found as the
                                ;contour description
N50 G90 G54
N60 F1000 G94
N10 X50. Y10.
N20 X33. Y11.
N30 X10.
N50 ....
N.. .....
N800 G71 P10 Q30                ;call shell cycle for stock removal cycle
...                             ;(In the stock removal cycle, "CALL BLOCK N10 TO N30"
                                ;is programmed)
...                             ;the lines printed in
...                             ;italics are found as the contour description
N999 ....
N10 X15.
N20 Y25.
N30 X33.
N1010 ...
N1020 .....
```

2.4.4 Macro commands with G65, G66 and G67

ISO dialect

In ISO dialect mode, G65 Pxx and G66 Pxx are used to call macros in the part program. The combination of several part program blocks which are terminated with M17 is known as a macro.

When calling the subprogram, a switch is made from ISO mode to Siemens mode.

The following commands are used for selection and deselection:

- G65 macro call, non-modal effective
- G66 macro call, modal effective
- Deselect G67 modal macro call

Siemens

G commands G65 Pxx and G66 Pxx start macro xx. G65 calls the Pxx subprogram once, G66 makes subprogram call Pxx modal and it is executed in each block with axial motion (as MCALL xx). G67 deselects the modal subprogram call again (corresponds to G80 for cycle calls).

In a part program block containing G65 or G66, the address Pxx is interpreted as the program number of the subprogram in which the macro functionality is programmed.
The number of passes of the macro can be defined with the address Lxx. If the number of passes is not programmed in the call block, the macro is run once. All other addresses in this part program block are interpreted as transfer parameters and their programmed values are stored in the system variables $C_A to $C_Z. These system variables can be read in the subprograms and evaluated for the macro functionality. If other macros with parameter transfer are called in a macro (subprogram), then the transfer parameters in the subprogram must be saved in internal variable before the new macro call.

To enable internal variable definitions, one must switch automatically to the Siemens mode during macro call. If another macro call is programmed in the subprogram, then the ISO dialect mode must be reselected in advance.

System variables for the addresses I, J, K

As the addresses I, J, and K can be programmed up to 10 times in a block containing macro call, the system variables of these addresses must be accessed with an array index.
The syntax of these three system variables thus is $C_I[..], $C_J[..], $C_K[..]. The values remain in the programmed sequence in the array. The number of I, J, K addresses programmed in the block is given in the variables $C_I_NUM, $C_J_NUM, $C_K_NUM.

The transfer parameters I, J, K for macro calls are treated in each case as one block even if the individual addresses are not programmed. If a parameter is reprogrammed, or a following parameter based on the I, J, K sequence has been programmed, it belongs to the next block.

The system variables $C_I_ORDER, $C_J_ORDER, $C_K_ORDER are set to detect the programming sequence in ISO mode. These are identical arrays to $C_I, $C_K and they contain the associated numbers of the parameters.

Note

The transfer parameters can only be read in the subprogram.

Example:

```
N5 I10 J10 K30 J22 K55 I44 K33
   Block1         Block2      Block3
```

```
$C_I[0]=10
$C_I[1]=44
$C_I_ORDER[0]=1
$C_I_ORDER[1]=3

$C_J[0]=10
$C_J[1]=22
$C_J_ORDER[0]=1
$C_J_ORDER[1]=2

$C_K[0]=30
$C_K[1]=55
$C_K[2]=33
$C_K_ORDER[0]=1
$C_K_ORDER[1]=2
$C_K_ORDER[2]=3
```

Cycle parameter $C_x_PROG

In the ISO dialect 0 mode, the programmed values can be evaluated in different ways, depending on the programming method (integer or actual value). The different evaluation is activated using machine datum.

If the MD is set, the control system responds as in the following example:

X100. ;X axis is traversed by 100 mm (100. with point => actual value)

Y200 ;Y axis is traversed by 0.2 mm (200 without point => integer value)

If the addresses programmed in the block are used as transfer parameters for cycles, then the programmed values always exist as real values in the $C_x variables. For integer values, one cannot take recourse to the programming method (real/integer) in the cycles any more, and therefore there is no evaluation of the programmed values with the correct conversion factor.

To find out whether REAL or INTEGER has been programmed, refer to system variable $C_TYP_PROG, which is structured just like $C_ALL_PROG and $C_INC_PROG. There is one bit for each address (A-Z). If the value is programmed as INTEGER, bit 0 is set, if it is REAL, 1 is set. If the value is programmed using a variable $<Number>, bit 2 = 1 is set.

Example:

P1234 A100. X100 -> $C_TYP_PROG == 1.

Only bit 0 is present, because only A was programmed as REAL.

P1234 A100. C20. X100 -> $C_TYP_PROG == 5.

Bit 1 and bit 3 (A and C) are present.

Restrictions:

A maximum of ten I, J, K parameters can be programmed in each block. Only one bit each is provided for I, J, K in the variable $C_TYP_PROG. Hence in $C_TYP_PROG bits is always set to 0 for I, J and K. Therefore it cannot be derived whether I, J or K is programmed as REAL or as INTEGER.

Parameters P, L, O, N can only be programmed as integers. A real value results in an NC alarm. The bit in $C_TYP_PROG is therefore always 0.

Modal macro calls

For modal macro calls, the programmed addresses are only written to the system variables in the call block (block with G66). The macro is then executed in each block with axial motion until deselected with G67 or until a new macro call is programmed with G66. Only macro parameters are provided for modal macros in the call block (= block with G66). The macro is first run in the next block with axial motion. (Process as with MCALL xx in Siemens mode.)

Example of macro call:

```
_N_M10_MPF:
N10 M3 S1000 F1000
N20 X100. Y50. Z33.
N30 G65 P10 F55 X150. Y100. S2000
N40 X50.
N50 ....
N200 M30
```

Example of a subprogram as a macro in Siemens mode:

```
_N_10_SPF:
N10 DEF REAL X_AXIS, Y_AXIS, SPEED, FEEDRATE
N15 X_AXIS = $C_X Y_AXIS = $C_Y SPEED = $C_S FEEDRATE = $C_F
N20 G01 F=FEEDRATE G95 S=SPEED
...
M17
```

2.4.5 Changing mode during macro calls with G65/G66

In the past during macro calls with G65/G66, a switch has been automatically made into Siemens mode.

The user can now decide whether a switch is to be made to Siemens mode at the start of the macro. If the first program line of the macro program contains the operation PROC<Program name>, a switch is made into Siemens mode. If this operation isn't there, ISO mode is retained in the macro program.

The user can then decide whether to create local variables (with DEF...) to save transfer variables. To do this, the user must switch into Siemens mode with the PROC operation. But he or she can also decide whether his or her macro program (e.g. an existing ISO dialect M/T macro) can be processed in ISO mode.

Example of the macro call:

```
_N_M10_MPF:
N10 M3 S1000 F1000
N20 X100. Y50. Z33.
N30 G65 P10 F55 X150. Y100. S2000
N40 X50.
N50....
N200 M30
```

Example of a subprogram as a macro in Siemens mode:

```
_N_0010_SPF:
PROC 0010 ;Changeover to Siemens mode
N10 DEF REAL X_AXIS, Y_AXIS, SPEED, FEEDRATE
N15 X_AXIS=$C_X Y_AXIS=$C_Y SPEED=$C_S FEEDRATE=$C_F
N20 G01 F=FEEDRATE G95 S=SPEED
....
N80 M17
```

Example of a subprogram as a macro in ISO mode:

```
_N_0010_SPF:
G290 ;Changeover to Siemens mode
     ;if transfer variables have to be read
N15 X_ACHSE=$C_X Y_ACHSE=$C_Y DREHZAHL=$C_S
N20 G01 F=$C_F G95 S=$C_S
N10 G1 X=$C_X Y=$C_Y
G291 ;Changeover to ISO mode
N15 M3 G54 T1
N20
....
N80 M99
```

2.4.6 Macro call via M function

Function

A macro can be called using M numbers in the same way as G65 (see "Mode changeover during macro calls with G65/G66" chap.).

10 M function replacements are configured using the following machine data:

- MD10814 $MN_EXTERN_M_NO_MAC_CYCLE and
- MD10815 $MN_EXTERN_M_NO_MAC_CYCLE_NAME.

Parameter transfer is identical to G65. Repetitions can be programmed with the L address.

Constraints

Only one M function replacement (or only one subprogram call) can be executed per part program line. Conflicts with other subprogram calls are reported using alarm 12722 "Channel %1 block %2 Several ISO_2/3 macro or cycle calls in the block". There is no further M function replacement in the replaced subprogram.

Otherwise, the same constraints are valid as in G65.

Conflicts with pre-defined and other defined M numbers are rejected with an alarm.

Configuration examples

Call of subprogram M101_MACRO via the M101 M function

MD10814 $MN_EXTERN_M_NO_MAC_CYCLE[0] = 101
MD10815 $MN_EXTERN_M_NO_MAC_CYCLE_NAME[0] = "M101_MACRO"

Call of subprogram M6_MAKRO via the M6 M function.

MD10814 $MN_EXTERN_M_NO_MAC_CYCLE[1] = 6
MD10815 $MN_EXTERN_M_NO_MAC_CYCLE_NAME[1] = "M6_MACRO"

Programming example for tool change with M function:

```
PROC MAIN
...
N10                 M6 X10 V20
...
N90                 M30
PROC M6_MACRO
...
N0010               R10 = R10 + 11.11
N0020               IF $C_X_PROG == 1 GOTOF N40          ;($C_X_PROG)
N0030               SETAL(61000)           ;programmed variable not
                                           ;transferred correctly
N0040               IF $C_V == 20 GTOF N60               ;($C_V)
N0050               SETAL(61001)
N0060               M17
```

2.4.7 Macro call via G function

Function

A macro can be called using a G number in the same way as G65 (see chap. "Mode changeover during macro calls with G65/G66").

50 G function replacements can be configured using the following machine data:

MD10816 $MN_EXTERN_G_NO_MAC_CYCLE and

MD10817 $MN_EXTERN_G_NO_MAC_CYCLE_NAME

The parameters programmed in the block are stored in the $C_variables. The number of macro repetitions is programmed with address L. The number of the programmed G_macros is stored in the variable $C_G. All the other G functions programmed in the block are treated as normal G functions. The programming sequence of the addresses and G functions in the block is random, and it does not have any effect on the functionality.

All ISO G codes, including G codes with a decimal point (= real value), can be replaced by a macro call.

G functions which are not replaced by a macro are still present in the control and can be redefined using MD10882 $MN_NC_USER_EXTERN_GCODES_TAB[ ].

Constraints

Only one G/M function replacement (or only one subprogram call) can be executed per part program line. Conflicts with other subprogram calls, e.g. if a modal subprogram call is active, are reported using alarm 12722 "Channel %1 block %2 Several ISO_2/3 macro or cycle calls in the block".

If a G macro is active, no other G/M macro or M subprogram is called.
M macros/subprograms are then executed as M functions and G macros as G functions, if there is an appropriate G function. Otherwise, alarm 12470 is triggered.

Otherwise, the same constraints are valid as for G65.

Configuration examples

Calling the subprogram G21_MACRO via G function G21

$MN_EXTERN_G_NO_MAC_CYCLE[0] = 21

$MN_EXTERN_G_NO_MAC_CYCLE_NAME[0] = "G21_MACRO"

$MN_EXTERN_G_NO_MAC_CYCLE[1] = 123

$MN_EXTERN_G_NO_MAC_CYCLE_NAME[1] = "G123_MACRO"

$MN_EXTERN_G_NO_MAC_CYCLE[2] = 421

$MN_EXTERN_G_NO_MAC_CYCLE_NAME[2] = "G123_MACRO"

Programming example

```
PROC MAIN
...
N0090 G291                                ;ISO mode
N0100 G1 G21 X10 Y20 F1000 G90            ;Call of G21_MACRO.spf,
                                          ;G1 and G90 are activated
                                          ;before the call of
                                          ;G21_MACRO.spf
...
N0500 G90 X20 Y30 G123 G1 G54             ;Call of G123_MACRO.spf,
                                          ;G1, G54 and G90 are activated
                                          ;before the call of
                                          ;G123_MACRO.spf
...
N0800 G90 X20 Y30 G421 G1 G54             ;Call of G421_MACRO.spf,
                                          ;G1, G54 and G90 are activated
                                          ;before the call of
                                          ;G123_MACRO.spf
...
N0900 M30
```

```
PROC G21_MACRO
...
N0010 R10 = R10 + 11.11
N0020 IF $C_X_PROG == 0
N0030 SETAL(61000)                        ;programmed variable not
                                          ;transferred correctly
N0040 ENDIF
N0050 IF $C_V_PROG == 0
N0060 SETAL(61001)
N0070 ENDIF
N0080 IF $C_F_PROG == 0
N0090 SETAL(61002)
N0100 ENDIF
N0110 G90 X=$C_X V=$C_V
N0120 G291
N0130 G21 M6 X100                         ;G21->activate metric measuring system
                                          ;(no macro call)
N0140 G290
...
N0150 M17
```

```
PROC G123_MACRO
...
N0010 R10 = R10 + 11.11
N0020 IF $C_G == 421 GOTOF label_G421
                                          ;Macro functionality for G123
N0040 G91 X=$C_X Y=$C_Y F500
...
...
N1990 GOTOF label_end
N2000 label_G421:                         ;Macro functionality for G421
N2010 G90 X=$C_X
Y=$C_Y F100
N202
...
...
N3000 G291
N2010 G123                                ;Alarm 12470, because G123 is not a
                                          ;G function and a
                                          ;macro call is not possible for
                                          ;active macro.
                                          ;exception: The macro was called
                                          ;as subprogram with CALL
                                          ;G123_MACRO.
N4000 label_end: G290
N4010 M17
```

2.4.8 High-speed cycle cutting G05 P..

G05 P.. high-speed cycle cutting is realized as a subprogram call.

Programming: G05 P.. L..

- Pxxxxx

  Subprogram number, max. 10 characters

  When calling, 0s are not filled as they are for M98.

- Lxxxx

  Number of passes, L1 applies if L is not programmed.

Example:

G05 P10123 L3 10123.mpf is passed 3 times.

This call calls any subprogram. This subprogram may be a precompiled program, but doesn't have to be. Only Siemens part programs can however be precompiled.

Siemens mode has no equivalent for the G05 ISO dialect function. CYCLE305 gives the user the opportunity to program their own functionality within the framework of the Siemens functionality.

The CYCLE305.spf cycle is called when programming G05 in the following scenarios:

- G05 without P in block is skipped without alarm.
- G05.1 with and without P is skipped without alarm.
- G05 P0 or P01 are reserved for high-speed remote buffer B. This function is not supported.

All addresses programmed in the block are written into the cycle parameters $C_xx in the scenarios stated. When calling CYCLE305, the mode does not automatically switch from ISO to Siemens. If CYCLE305.spf is to be processed in Siemens mode, there must be a PROC operation in the first program line as for macro calls with G65/G66.

As when programming G05, all functions programmed in the block are executed, i.e. programmed axes are traversed, auxiliary functions output etc. The programmed addresses are only written into the cycle parameters as additional information.

If G05 is programmed with a subprogram call (M98 P..) in the same block, alarm 12722 "Channel %1 block %2 Several ISO_2/3 macro or cycle calls in a block" is output.

2.4.9 Switchover modes for DryRun and skip planes

Changeover of the skip planes (DB21.DBB2) always represents an intervention in the program run, which has led to a short-term drop in velocity on the path. The same is true of the changeover of the DryRun mode (DryRun = dry run feedrate DB21.DBB0.BIT6) from DryRunOff to DryRunOn or vice-versa.

Drops in velocity can now be avoided by a new changeover mode that is limited in its function.

A drop in velocity is no longer required with a machine data assignment of 10706 $MN_SLASH_MASK==2 while changing the skip planes (i.e., a new value in the PLC->NCK-Chan interface DB21.DBB2).

Note

The NCK processes blocks in two steps, the preprocessing and main runs (also pre-travel and main run). The result of the premachining migrates to the preprocessing memory. Main machining takes the oldest block in each case out of the preprocessing memory and traverses its geometry.

NOTICE

Premachining is changed over with the machine data assignment $MN_SLASH_MASK==2 during a change in skip plane! All blocks located in the preprocessing memory are traversed with the old skip plane. The user normally does not have any control over the fill level of the preprocessing memory. He sees the following effect:
This will also be active "sometime" after the changeover of the DryRun mode!

Note

The part program command STOPRE vacates the preprocessing memory. If the skip plane is changed before STOPRE, then all the blocks after STOPRE are changed over securely. The same is valid for an implicit STOPRE.

Changing over DryRun mode has the same constraints.

No drop in velocity is required when changing the DryRun mode with the machine data assignment 10704 $MN_DRYRUN_MASK==2. Here too, only the premachining that leads to the above-mentioned restrictions, is switched.

2.4.10 Eight-digit program number

MD20734 $MC_EXTERN_FUNCTION_MASK, bit 6=1 activates an eight-digit program number selection. This function impacts on M98 (see "Subprogram technique M98" chapter), G65/66 (see "Mode changeover during macro calls with G65/G66" chapter) and M96 (see "Interrupt program with M96/M97 (ASUB)" chapter).

y: Number of program passes

x: Program number

Subprogram call

$MC_EXTERN_FUNCTION_MASK, bit 6 = 0

M98 Pyyyyxxxx or

M98 Pxxxx Lyyyy

Program number max. 4 digits

Addition of program number always to 4 digits with 0

Example:

M98 P20012: calls 0012.mpf 2 passes

M98 P123 L2: calls 0123.mpf 2 passes

$MC_EXTERN_FUNCTION_MASK, bit 6 = 1

M98 Pxxxxxxxx Lyyyy

There is no extension with 0, even if the program number has less than 4 digits.

The number of passes and program number in P(Pyyyyxxxxx) cannot be programmed, the number of passes must always be programmed with L!

Example:

M98 P123: calls 123.mpf 1 pass

M98 P20012: calls 20012.mpf 1 pass,

Caution: This is no longer compatible with ISO dialect original!

M98 P12345 L2: calls 12345.mpf 2 passes

Modal and blockwise macro G65/G66

$MC_EXTERN_FUNCTION_MASK, bit 6 = 0
G65 Pxxxx Lyyyy
Program number is always expanded to 4 digits using 0s. Program numbers with more than 4 digits result in an alarm.

$MC_EXTERN_FUNCTION_MASK, bit 6 = 1
G65 Pxxxx Lyyyy
0s are not added, even if the program number is less than 4 digits long. A program number with more than 8 digits leads to an alarm.

Interrupt M96

Does not function in SINUMERIK 802D sl.

$MC_EXTERN_FUNCTION_MASK, bit 6 = 0
M96 Pxxxx
Program number is always expanded to 4 digits with 0s

$MC_EXTERN_FUNCTION_MASK, bit 6 = 1
M96 Pxxxx
0s are not added, even if the program number is less than 4 digits long. A program number with more than 8 digits leads to an alarm.

2.4.11 System variable for level stack in ISO mode

In standard mode, the current program level is displayed in the $P_STACK system variable. This variable is affected by all subprogram calls and returns. There are however subprogram calls in ISO mode for which the current user variable level is **not** changed. You must know the current program level in ISO mode in order to realize level-specific variables using GUDs. System variable $P_IPO_STACK provides the current program level in ISO dialect mode.

The table below shows all the possible subprogram and macro calls in ISO mode and how they impact on the current program level.

The calls in ISO mode are mapped on calls in standard mode such that the $P_STACK variable contains the same information as before even in ISO mode.

The number of maximum possible subprogram calls remains unchanged.

System variable $P_IPO_STACK is incremented whenever a subprogram is started which is programmed as a macro call with G65, G66, G code or M macro in ISO mode.
$P_IPO_STACK is decremented again when returning from such an ISO macro. If there are no ISO macros active, $P_IPO_STACK = 0. $P_IPO_STACK therefore provides the number of currently active ISO macros.

When calling an interrupt program defined with M96 Pxx, variable $P_IPO_STACK is also incremented depending on MD $MC_EXTERN_FUNCTION_MASK, bit 11.

$MC_EXTERN_FUNCTION_MASK
Bit 12 = 0, $P_IPO_STACK is not changed by the interrupt program.
Bit 12 = 1, $P_IPO_STACK is incremented by the interrupt program.

Cycle calls with e.g. G81, G77 etc. or functions realized internally with cycles, e.g. G05, G72.1 etc. and subprogram calls with M98 Pxx do not affect $P_IPO_STACK.

Example:

Subprogram calls in ISO and standard mode.
M98 stands for subprogram calls without an increase in level
G65 P stands for a macro calls with an increase in level

Table 2- 4 Subprogram and macro calls

$P_STACK	$P_IPO_STACK	Level 1	Level 2	Level 3
1	1	O111.mpf		
1	1	N5 M98 P2222		
2	1		O2222.mpf	
2	1		G65 P3333	
3	2			O3333.mpf
3	2			M99
2	1		M99	
M98 does not forward the levels. O1111.mpf and O2222.mpf work with the same $P_ISO_STACK content, G65 forwards the levels such that O3333.mpf sees different content. $P_STACK continues to display the levels in standard mode.				
$P_STACK	**$P_IPO_STACK**	**Level 1**	**Level 2**	**Level 3**
1	1	O1111.mpf		
1	1	N5 G65 P2222		
2	2		O2222.mpf	
2	2		M98 P3333	
3	2			O3333.mpf
3	2			M99
2	1		M99	
Switching from ISO to standard mode				
$P_STACK	**$P_IPO_STACK**	**Level 1**	**Level 2**	**Level 3**
1	1	O1111.mpf		
1	1	G291		
1	1	N5 M98 P2222		
2	1		O2222.mpf	
2	1		G290	
2	1		3333( )	
3	2			3333.mpf
3	2			M30
2	1		G291	
2	1		M99	
1	1	N10 M30		

$P_STACK	$P_IPO_STACK	Level 1	Level 2	Level 3
Switching from standard to ISO mode				
1	1	1111.mpf		
1	1	N5 G290		
1	1	N10 2222( )		
2	2		2222.mpf	
2	2		G291	
2	2		M98 P3333	
3	2			O3333.mpf
3	2			M99
2	2		G290	
2	2		M17	
1	1	N15 M30		

List of possible subprogram and macro calls in ISO mode

M98 Pxxxx	Subprogram call	Level is not changed
M98 Pxxxx Lyyyy	Up call with iteration	Level is not changed
G65 P	Non-modal macro	Level is increased
G66 P	Modal macro	Level is increased
G05	UP call CYCLE305	Level is not changed
M macro subst		
10814: EXTERN_M_NO_MAC_CYCLE		Level is increased
M up subst.		
10715: M_NO_FCT_CYCLE		Level is not changed
T subst		
10717: T_NO_FCT_CYCLE_NAME		Level is not changed
G subst		
10816: EXTERN_G_NO_MAC_CYCLE		Level is increased
M96	Interrupt ASUB	Level is changed depending on $MC_EXTERN_FUNCTION_MASK, bit 12
Shell cycles:		Level is not increased
G code cycles:		
G22 G23 G27 G28 G30 G30.1 G72.1 G50		Level is not increased
G code cycles, shell cycles:		
$P_ISO_STACK has no meaning for the user because these cycles do not offer access for writing.		

Depending on machine datum $MC_EXTERN_FUNCTION_MASK, bit 12, variable $P_ISO_STACK is incremented when calling an interrupt program (ASUB).

- Bit 12 = 0

  Variable $P_ISO_STACK is not changed when calling an interrupt program defined with M96 Pxx

- Bit 12 = 1

  Variable $P_ISO_STACK is incremented when calling an interrupt program defined with M96 Pxx

Tool changes and tool offsets

3

3.1 Shared tool offset memory

3.1.1 Tool offsets: T, D (ISO dialect M)

Tool data, T/D number H number

As the Siemens and ISO dialect programs are intended to run alternately in the controller, they must be implemented using the Siemens tool data memory.

Each offset data set is assigned to a tool. This offset data set contains the length, geometry and wear.

In Siemens mode the offset memory is addressed with T (tool number) and D (cutting edge number), or **T/D number** for short.

In ISO dialect M programs the offset memory is addressed with D (radius) or H (length), referred to below as the **H number**.

In order to be able to assign this H number unambiguously to a T/D number, an element $TC_DPH[t,d] has been added to the offset data set. The H number of the ISO dialect is entered in this element.

Table 3- 1 Example: Tool offset data set

T	D/cutting edge	H number $TC_DPH	Radius	Length
1	1	10		
1	2	11		
1	3	12	100.00	250.00
2	1	13		
2	2	14		
2	3	15		

Example:

Siemens program	ISO dialect program
N5 T1	N5 T1
N10 G41 D3	N10 G41 H12 or G41 D12

When **programming the H value** in the ISO dialect M program, the corresponding $TC_DPH is used to search for the offset data set in the active T and the tool is selected.

If an offset data set does not include an H number, this offset cannot be activated in ISO dialect mode.

If an H is programmed but no offset data set with the corresponding H number is found or the associated tool T is not selected, an alarm is output.

3.1.2 Possible H numbers

H = 0

H0 is an offset with the offset value 0. If H0 is programmed during G43/G44, G43/G44 remains active but with the tool length 0. H0 cannot be programmed while G41/G42 is active, however.

H = unique

Each H number can only occur once in any TO unit, otherwise unambiguous addressing of the offset data set is not possible. If you try to assign an H number for a second time, an alarm "17183 Channel %1 Set %2 H number already exists in T= %3 with D=%4" is sent from the program on attempting to write the values. This alarm is offset data set-capable and NC start clear.

Example:

```
N5 $TC_DPH[1,1] = 5
N10 $TC_DPH[2,1] = 5
```

If you try to assign an H number twice via BTSS (HMI, PLC), a negative acknowledgement is output for this write attempt.

Changing the offset memory

Existing tool offsets can be overwritten with G10. New tool offsets are not created with G10.

Tool length geometry offset: G10 L10 Pxx Ryy

Tool length wear offset: G10 L11 Pxx Ryy

Radius geometry offset: G10 L12 Pxx Ryy

Radius wear offset: G10 L13 Pxx Ryy

P indicates the H number of the offset memory and R the value.

L1 can be programmed in place of L11.

Active plane

To ensure that the assignment of tool length offsets to the geometry axes is independent of the plane selection, the setting data 42940 $SC_TOOL_LENGTH_CONST must contain the value 17. In this way length 1 is always assigned to the Z axis.

Tool length selection

The tool length and tool radius are always programmed with D or H.

Example:

T	D/cutting edge	H number $TC_DPH	Radius	Length
2	3	4	10	15

ISO dialect M:

T2

G43 H4 or D4 ;Length selection

G42 D4 or H4 ;Radius selection

In ISO dialect M programs which are programmed with different D and H numbers, the offset value must be entered twice.

Example:

T	D/cutting edge	H number $TC_DPH	Radius	Length
2	3	4	10	15
2	4	5	10	15

ISO dialect M:

T2

G43 H4 ;Length offset from T2 D3

G42 D5 ;Radius and length offset from T2 D4

Flat D number

If flat D numbers are active, the T is programmed independently of the H number. The system no longer checks whether the H number matches the selected tool.

Even with flat D numbers an H number must be assigned to each offset memory.

Tool management

If tool management is active, sister tools have the same H number. They are differentiated by means of duplo numbers.

With H99 the offset D1 for the currently selected tool is activated if **tool management** is active.

In ISO dialect M only numerical expressions are permissible as tool identifiers. Strings are not permissible as identifiers.

Example: T = "2", selection with T2.

Tool length offset in multiple axes

Tool length offsets can be activated in multiple axes. The resulting tool length offset cannot be displayed, however.

If T and D numbers are active, the Siemens T and D numbers are displayed.

For the active ISO dialect H and D numbers there are new BTSS variables that can be displayed.

The machine data 22220 $MC_AUXFU_T_SYNC_TYPE defines whether output to the PLC takes place during or after the movement.

The machine data 20110 $MC_RESET_MODE_MASK, bit6 can be used to specify that the tool length offset remains active after a reset.

MD20156 $MC_EXTERN_RESET_GCODE_MODE[7] is used to define whether the G code of group 8 (G43, G44, G49) is retained after a reset or whether the setting from MD20254 $MC_EXTERN_RESET_GCODE[7] takes effect after a reset.
The default settings for both machine data should be set such that after a reset G49 is active and the tool length offset is deselected.

Example: Tool selection in ISO dialect M:

```
;(Fanuc 0 M tool offset with T, cutting edge number
;(the offsets are)
;(with G10)
G290
;Tool offset memory T2 cutting edge1:
N5000 $TC_DP1[2,1]=10                    ;Type
N5000 $ TC_DP1[2,1]=7                    ;ISO H number
;Tool offset memory T3 cutting edge2:
N5000 $TC_DP1[3,2]=10                    ;Type
N5000 $TC_DP1[3,2]=3                     ;ISO H number
;Tool offset memory T4 cutting edge3:
N5000 $TC_DP1[4,3]=10                    ;Type
N5000 $TC_DP1[4,3]=8                     ;ISO H number
G291                                     ;Write tool offsets


;-------------------------
;T2 cutting edge1
G10 L12 P7 R5
;T3 cutting edge2
G10 L10 P3 R15
G10 L12 P3 R10
N8 G01 G40 F5000 X0 Y0 Z0
N10 X50.
N15 Y50
N17 Z10.
N20 X0
N25 Y0
```

```
N30 X-10 Y-10
N30 T2                                  ;Tool 2
N33 G43 H7 Z0                           ;H number 7
N35 G41 X0 Y0 Z0 D7
N40 X50.
N45 Y50.
N48 Z10.
N50 X0
N55 Y0
N60 G40 X-10 Y-10
N65 T3
N68 G43 H3 Z0
N70 G42 X0 Y0 Z0 D3
N75 X50.
N77 Y50.
N78 Z10.
N80 X0
N85 Y0
N90 G40 X-10 Y-10
N95 T4
N98 G43 H8 Z0
N100 G41 X0 Y0 Z0 D8
N105 X50.
N110 Y50.
N112 Z10.
N115 X0
N120 Y0
N125 G40 X-10 Y-10
M30
```

Whether the offset takes effect in the selection set or the next time the axis is programmed is defined by machine data 20382 $MC_TOOL_CORR_MOVE_MODE.

3.1.3 Tool offset T (ISO dialect T)

The tool data is located in the Siemens tool data memory and corresponds to the offset data for a Siemens cutting edge.

The meaning corresponds to the cutting edge position for Siemens turning tools.

In ISO dialect T, the tool number and correction number are both programmed in the T word. During interpretation, the T word is split according to the tool number and correction number. The following possibilities now exist:

10889 $MN_EXTERN_DIGITS_OFFSET_NO, number of digits for correction number.
Range of values 0-8, default value 0

The function is deactivated with 0.
The number of digits is counted from the T word from the **right**, the rest is the tool number.
Example: $MN_EXTERN_DIGITS_OFFSET_NO = 3
T1234 is split into T1 H234

10888 $MN_EXTERN_DIGITS_TOOL_NO, number of digits for tool number.
Range of values 0-8, default value 2
The function is deactivated with 0.
The number of digits is counted from the T word from the **left**, the rest is the correction number.
Example: $MN_EXTERN_DIGITS_TOOL_NO = 3
T1234 is split into T123 H4

Only one of the two functions may be active to split the T word. If both machine data have a value of 0, splitting is not possible. Programming T results in NC alarm 12550.
If both machine data have a value of < > 0, splitting is not possible. Programming T results in NC alarm 12550.

The function is compatible with the standard values of previous statuses.

Examples

$MN_EXTERN_DIGITS_OFFSET_NO = 0
$MN_EXTERN_DIGITS_TOOL_NO = 2
Splitting according to tool numbers, 2 digits
T123 becomes T12 H3
T0123 becomes T1 H23

$MN_EXTERN_DIGITS_OFFSET_NO = 3
$MN_EXTERN_DIGITS_TOOL_NO = 0
Splitting according to tool numbers, 3 digits
T1234 becomes T12 H234
T01234 becomes T1 H234

$MN_EXTERN_DIGITS_OFFSET_NO = 3
$MN_EXTERN_DIGITS_TOOL_NO = 2
Splitting not possible because both functions are activated. T programming results in alarm 12550.

$MN_EXTERN_DIGITS_OFFSET_NO = 0
$MN_EXTERN_DIGITS_TOOL_NO = 0
Splitting not possible because both functions are deactivated. T programming results in alarm 12550.

Changing the offset memory

Existing tool offsets can be overwritten with G10. New tool offsets are not created with G10.

G10 P<100 / 10000 X Y R Q Geometry

G10 P>100 / 10000 X Y R Q Wear

P100/10000	;With MD20734 EXTERN_FUNCTION_MASK, bit 1 is selected, ;when P<100 or 10000, whether differentiation is by geometry ;or wear.
X Y Z	;Offset values absolute or incremental, depending on G90/91
U V W	;Offset values incremental
R	;Radius
Q	;Cutting edge position

Tool offset selection with $TC_DPH

In ISO dialect T the "flat D numbers" function has previously always been active. The D numbers are unique; with the command Txxyy or G10 Pyy the Siemens cutting edge number is addressed with yy. In order to use tool management in ISO dialect T, structured D numbers must be addressed. Just as in ISO dialect M, each cutting edge is therefore given a parameter $TC_DPH[°], which allows a cutting edge to be addressed unambiguously within a TO unit.

The function is switched on with MD10890 $MN_EXTERN_TOOLPROG_MODE bit 2=1.

If the function is active, the tool offset must always be addressed with the H number in ISO dialect T. Programs which address the cutting edge number no longer run. The parameter $TC_DPH[ ] is only created if $MN_EXTERN_TOOLPROG_MODE bit 2=1. The H numbers must be allocated unambiguously within a TO unit, otherwise alarm 17183 is output.

There are three options:

$MN_MM_TYPE_OF_CUTTING_EDGE=1 flat D number

1. Flat D number + $MN_EXTERN_TOOLPROG_MODE bit 2=0

The offset is always addressed with cutting edge D.

```
G290
N605 $TC_DP1[1]= 500
N615 $TC_DP1[2]= 500
N625 $TC_DP1[3]= 500
N635 $TC_DP1[4]= 500
G291
N650 G10 P2 X10                          ;Write cutting edge 2 geometry
N655 G10 P102 X1                         ;Write cutting edge 2 wear
N670 T0102                               ;Select cutting edge 2
N675 T0105                               ;Alarm because cutting edge 5
                                         ;does not exist
```

2. Flat D number + $MN_EXTERN_TOOLPROG_MODE bit 2=1

The offset is always addressed with the H number.

```
G290
N705 $TC_DP1[1]= 500
N708 $TC_DPH[1]=11
N710 $TC_DP1[2]= 500
```

```
N715 $TC_DPH[2]=22
N720 $TC_DP1[3]= 500
N725 $TC_DPH[3]=33
N730 $TC_DP1[4]= 500
N735 $TC_DPH[4]=44
G291
N740 G10 P22 X10.                          ;Write cutting edge 2 geometry
N745 G10 P122 X1.                          ;Write cutting edge 2 wear
N747 G10 P55 X10.                          ;Alarm 12550 because cutting edge does
                                           ;not exist with H55
N750 T0122                                 ;Cutting edge 2 is selected
N752 T0155                                 ;Alarm 12550 because cutting edge does
                                           ;not exist with H55
$MN_MM_TYPE_OF_CUTTING_EDGE=0              ;Structured D number
```

3. Structured D number + $MN_EXTERN_TOOLPROG_MODE bit 2=1

The offset is always addressed with the H number.

```
G290
N805 $TC_DP1[1,1]= 500
N808 $TC_DPH[1,1]=11
N810 $TC_DP1[1,2]= 500
N815 $TC_DPH[1.2]=22
N820 $TC_DP1[2,1]= 500
N825 $TC_DPH[2,1]=33
N830 $TC_DP1[2,2]= 500
N835 $TC_DPH[2,2]=44
G291
N840 G10 P22 X10                           ;Write T1 cutting edge 2 geometry
N845 G10 P122 X1                           ;Write T1 cutting edge 2 wear
N847 G10 P55 X1                            ;Alarm 12550 because cutting edge does
                                           ;not exist with H55
N850 T0122                                 ;Select T1 cutting edge 2.
N855 T0244                                 ;Select T2 cutting edge 2
                                           ;Alarm because cutting edge
                                           ;does not exist in T2 with H22.
```

3.1.4 Tool change cycle

ISO dialect mode

A subprogram is assigned to the T command using MD10717 T_NO_FCT_CYCLE_NAME. Each set containing a T command is executed and then the subprogram is called. The T value is not output; the T word has to be programmed again in the cycle.

In the subprogram the system variable $C_T_PROG or $C_D_PROG can be used to query whether T or D has been programmed. The values can be read with the system variables $C_T and $C_D respectively. If another T command is programmed in the subprogram, no replacement is made but the T word is output to the PLC.

A subprogram can be assigned to an M function (e.g., M06) using MD10715 M_NO_FCT_CYCLE and 10716 M_NO_FCT_CYCLE_NAME.

The mapping of M, T programming to cycle calls is the same in ISO dialect mode as in Siemens mode.

If T and M6 are programmed in a set, the programmed T number can be queried in the cycle called with M6 using GETSELT(). GETSELT() gets the T number of the preselected tool. In the block search the M/T call is likewise mapped to the cycle call. At the end of the search the change cycle must be started from the PLC side.

Sequence:

```
N20 T1234
N30 M6                                  ;Change tool
N40 H3 G43                              ;Activate tool length offset in T1234
N50 T333                                ;Tool preselection
N60 G1 X10                              ;T1234 offset is active
N70 M6                                  ;Load tool 333, D0 H0 active
N80 H4                                  ;Activate new tool length offset
N90 .....
```

Cycles and contour definition

4

4.1 Sequence of cycle calls in the external CNC system using G commands

General description

The functionality of the ISO dialect cycles is realized in the Siemens standard cycles:

A shell cycle is called from the ISO dialect program. All addresses programmed in the block are transferred to this shell cycle in the form of system variables. The shell cycle customizes this data to the standard Siemens cycle and calls its name.

The machine manufacturer can replace the shell cycles with its own ones.

Cycle parameters

During machining cycles, various cycle parameters should be preset in channel-specific GUDs (Global User Data). The names and meanings of the GUDs are listed in the "Global user data (GUD)" chapter.

Sequence for calling cycles using G command

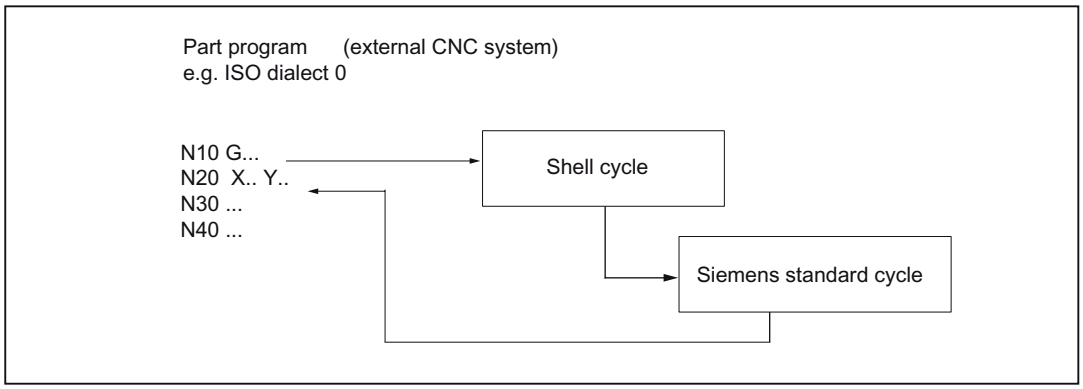


Figure 4-1 General cycle sequence in ISO dialect mode

Shell cycle

The customizations, required due to the ISO dialect programming syntax, are undertaken in the shell cycle. The existing SINUMERIK cycles do not need to be changed for this. The shell cycle name is permanently assigned.

Sequence:

1. The cycle (e.g. G81) is programmed in ISO dialect mode
2. A switch is made automatically to Siemens mode and the associated shell cycle called (see previous figure)
3. The shell cycle calls the associated standard Siemens cycle

Programming with G290 is not needed. A switch is automatically made to the external CNC system when returning.

NOTICE
The cycles may only be called with the G commands. This ensures that the shell cycle is provided with the appropriate cycle parameters. The shell cycle **must not** be called directly with CALL CYCLE3xx!

Modally effective cycles

If a modal cycle is active, the shell cycle is called in each NC block. If there are no axis positions (X, Y or Z) programmed in the NC block, the standard Siemens cycle is not called.

Addresses programmed in the block (F etc.) are activated by the shell cycle. For example, if a feedrate has not been programmed, the current feedrate is used as the path feedrate.

Cycle parameters can be programmed in the following blocks while a modal cycle is active. These parameters are written to the system variables so that the shell cycle works with the modified parameters.

Unlike modal macros, modal cycles are executed in the call block (e.g. block with G81 etc.).

Cycle deselection:

G80 or a G function of the 1st G group is used for deselection.

Example:

```
N10 G81 X10. Y20. Z-15. R5 F1000
                            Drilling position X10 mm, Y20 mm
                            Drilling depth Z-15 mm
                            Datum plane 5 mm
                            Drilling feedrate F.. (mm/min or mm/rev.)
N20 X50. Y30. R10           Drilling position X50 mm, Y30 mm,
                            New datum plane 10 mm
N30 G80                     Delete cycle G81
```

Writing cycle variable, depending on programmed addresses in block

During active modal cycles, to date all programmed addresses in the block have always been written into the cycle variables. The variables are evaluated in the cycle where a decision is made on the basis of the cycle logic as to how the variables have to be used.

In many cases this results in the cycle parameters being described even if they cannot be interpreted as cycle parameters because of their programming syntax.

None or no longer all of the programmed addresses are therefore written in the cycle parameters for the following functions:

`M98 P3 L2 X10 Y20`	Addresses Pxx and Lxx are not written in the cycle parameters.
`G05 P5 L2 X10 Y20`	Addresses Pxx and Lxx are not written in the cycle parameters.
`G05 P1 L2 X10 Y20`	During an active modal cycle, alarm 12722 is output because CYCLE305, for which the programmed values are actually intended, is called here after the modal cycle
`G54 P10 X10 Y20 M44`	Address Pxx is not written in the cycle parameters
`G31 P98 X30 F100`	Addresses Pxx, Fxx and axis values are not written in the cycle parameters.
`G31 P1 X30 Y20 F100`	None of the programmed addresses are written in the cycle parameters
`G51 P1000 I2 J3 K2 X30 Y40`	None of the programmed addresses are written in the cycle parameters
`G50 P10000 X10 Y30`	All parameters are written in the cycle parameters

4.2 Global user data (GUD)

Table 4- 1 GUD7 for programmed cycle values (ISO dialect program data)

GUD	Description/use	CYCLE
Real values		
_ZFPR[0]	Basis (current position for 1st call with G..), retraction position for G98 active	381M, 383M, 384M, 387M
_ZFPR[1]	Datum plane, retraction position for G99 active (only retraction to starting position possible for G87).	381M, 383M, 384M, 387M
_ZFPR[2]	Final drilling depth, absolute	381M, 383M, 384M, 387M
_ZFPR[3]	Retraction position, depending on G98/G99 (basis/R plane)	381M, 383M, 384M, 387M
_ZFPR[4]	Drilling feedrate	381M, 383M, 384M, 387M
_ZFPR[5]	Dwell time (s) at final depth (G82/G89/G76/G87) [ms]	381M, 384M, 387M
_ZFPR[6]	1st drilling depth (individual drilling depth) incr. (G73/G83)	383M

GUD	Description/use	CYCLE
_ZFPR[7]	1st absolute drilling depth (G73/G83)	383M
_ZFPR[8]	Lifting/feed in distance (G76)	387M
_ZFPR[9]	Speed for tapping (G74/G84)	384M
_ZFPR[10]	Programmable holding distance when dipping back into hole G83 Values: > 0 programmable value applies = 0 automatic calculation	383M
_ZFPR[20]	Basis (current position for 1st call)	383T, 384T, 385T
_ZFPR[21]	R plane	383T, 384T, 385T
_ZFPR[22]	Final drilling depth, absolute	383T, 384T, 385T
_ZFPR[23]	Retraction position (1=G98, 2=G99)	383T, 384T, 385T
_ZFPR[24]	Thread lead/drilling feedrate	376T, 383T, 384T, 385T
_ZFPR[25]	Dwell time at final depth	383T, 384T, 385T
_ZFPR[26]	Speed for tapping	384T
_ZFPR[27]	End point X	371T, 372T, 373T, 376T
_ZFPR[28]	End point Z	371T, 372T, 373T, 376T
_ZFPR[29]	Start point offset X (taper thread)	371T, 372T, 376T
_ZFPR[30]	Thread start point X	376T
_ZFPR[31]	Thread start point Z	376T
_ZFPR[32]	First drilling depth	383T
Integer values		
_ZFPI[0]	Current G code of ISO dialect drilling cycle	381M, 383M, 384M
_ZFPI[1]	M function for spindle start (M3, M4) after spindle stop	381M, 384M
_ZFPI[20]	Current G code of thread cycle/drilling cycle	383T, 384T, 385T
_ZFPI[21]	Spindle direction (3=M3, 4=M4)	383T, 384T, 385T
_ZFPI[22]	Scrubbing type of stock removal processing	370T, 371T, 372T, 373T
_ZFPI[23]	Deep hole/drilling type of processing	383T

Table 4- 2 GUD7 for cycle setting data (ISO dialect setting data)

GUD	Description/use	
Real values		
_ZSFR[0]	Safety clearance to datum plane	381M, 383M
_ZSFR[1]	Retraction amount from chip breaking (G73)	383M
_ZSFR[2]	Angle offset for oriented spindle stop, tool must be aligned in +X direction (G76) Retraction direction: -X G17 plane XY -Z G18 plane ZX -Y G19 plane YZ	387M
_ZSFR[20]	Safety clearance to datum plane	383T, 384T
_ZSFR[21]	Safety clearance to chip breaking	383T, 385T
Integer values		
_ZSFI[0]	0=Drilling axis is vertical to plane (standard) 1=Drilling axis always "Z"	381M, 383M, 384M, 387M
_ZSFI[1]	0= Tapping without floating tapholder 1= Tapping with floating tapholder 2= Deep hole tapping with chip breakage 3= Deep hole tapping with chip removal	384M,387M
_ZSFI[2]	Factor (1-200%) for retraction speed during tapping (G74/G84)	384M
_ZSFI[3]	Polar coordinates 0=OFF 1=ON	381M, 383M, 384M, 387M
_ZSFI[20]	Deep hole drilling with chip breakage/removal	383T, 385T
_ZSFI[22]	Factor for retraction speed	384T
_ZSFI[23]	Dwell time for G95, 0=seconds, 1=revolutions	383T
_ZSFI[24]	Number of non-cuts	376T
_ZSFI[25]	Facet angle	376T
_ZSFI[26]	Thread runout length (n·incline)	376T
_ZSFI[27]	Min. infeed depth	376T
_ZSFI[28]	Finishing allowance	376T
_ZSFI[29]	Path travel amount during cut-in cycle	374T
_ZSFI[30]	Depth of cut during stock removal cycle	371T, 372T
_ZSFI[31]	Path travel amount during stock removal cycle	371T, 372T
_ZSFI[32]	X axis feed in value for contour repeat	373T
_ZSFI[33]	Z axis feed in value for contour repeat	373T
_ZSFI[34]	Hole pitch for contour repeat	373T
_ZSFI[39]	G code system 2=B, 1=A, 3=C	300, 328, 330, 370T, 371T, 372T, 373T, 374T, 376T

4.3 Drilling cycles (ISO dialect M)

4.3.1 Overview and parameter description

The drilling cycles are modal. When a drilling mode is active, only the new parameters have to be programmed if a parameter is changed.

No traversing is executed if:

- no value is programmed for X, Y and Z in the NC block
- the number of repeats K=0 has been programmed

The retraction position applies to all drilling cycles

- G98 retraction at basis
- G98 retraction at datum plane

Overview

Table 4- 3 Overview of drilling cycles

External cycle call	Description
G73 X.. Y.. Z.. R.. F.. Q..	Deep hole drilling cycle with chip breakage
G74 X.. Y.. Z.. R.. F.. P..	Left tapping cycle
G76 X.. Y.. Z.. R.. F.. Q.. P..	Fine drill cycle
G80	Cycle off; cycle is also deselected by programming a G function from the 1st G group.
G81 X.. Y.. Z.. R.. F..	Drilling cycle; drilling, retraction with G00
G82 X.. Y.. Z.. R.. F.. P..	Drilling cycle; drilling, dwell time, retraction with G00
G83 X.. Y.. Z.. R.. F.. Q..	Deep hole drilling cycle with chip removal
G84 X.. Y.. Z.. R.. F.. P..	Right tapping cycle
G85 X.. Y.. Z.. R.. F..	Drilling cycle; drilling, retraction with drilling feedrate
G86 X.. Y.. Z.. F.. R.. K..	Drilling cycle, retraction with G00
G87 X.. Y.. Z.. F.. R.. P.. Q.. K..	Reverse countersinking
G89 X.. Y.. Z.. F.. R.. P.. K..	Drilling cycle, retraction with machining feedrate

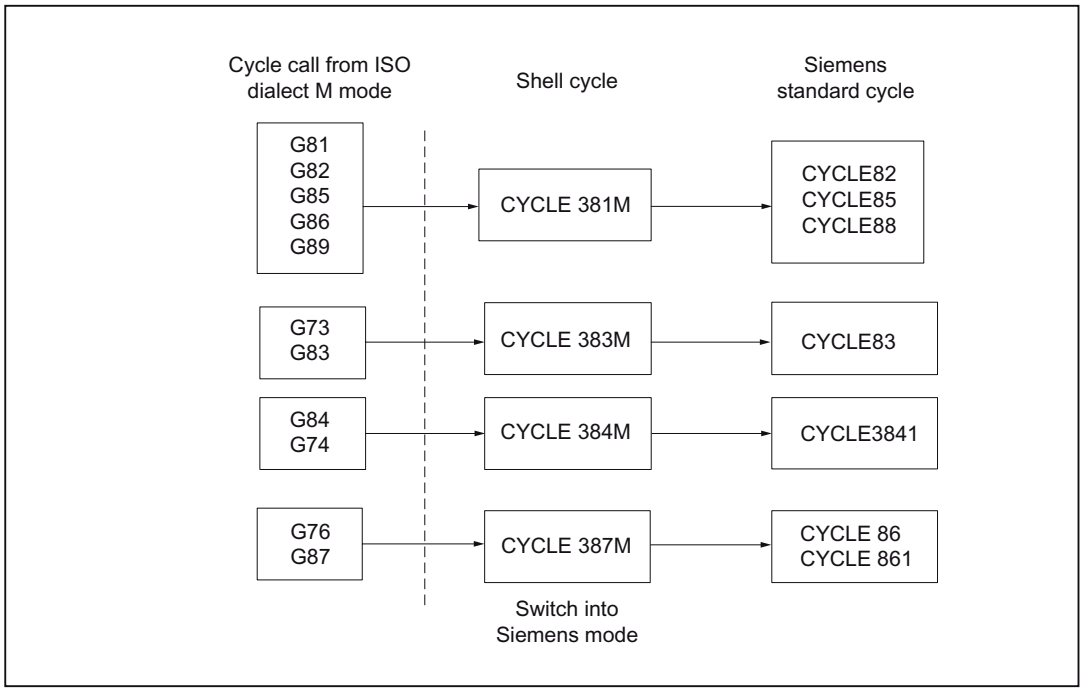


Figure 4-2 Assignment of cycle call to standard Siemens cycle in ISO dialect M mode using shell cycle

Example: ISO dialect M

```
N10 G81 X100. Z-50. R20 F100
```

G81 is used to automatically call the CYCLE381M shell cycle.

The calculations are carried out in the shell cycle and the standard drilling cycle CYCLE81 then called.

Parameter description

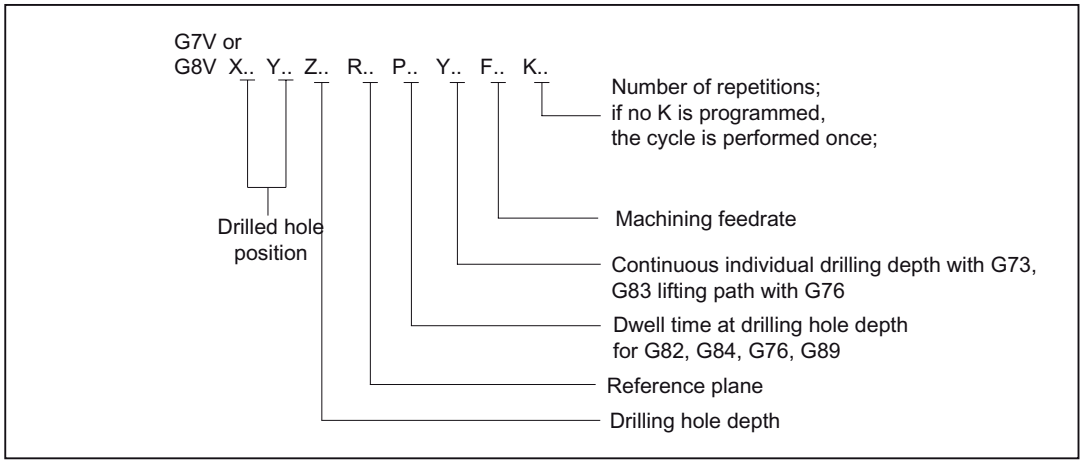


Figure 4-3 Description of permissible parameters for G17 (X/Y plane)

Plane

In drilling cycles, one generally assumes that the current coordinate system in which the operation is to be executed, is defined through the selection of plane G17, G18 or G19 and activation of a programmed work offset.
The drilling axis is then always the application of this coordinate system.

Table 4- 4 Plane definition

Defined plane	Position of hole	Depth
G17	X, Y	Z
G18	Z, X	Y
G19	Y, Z	X

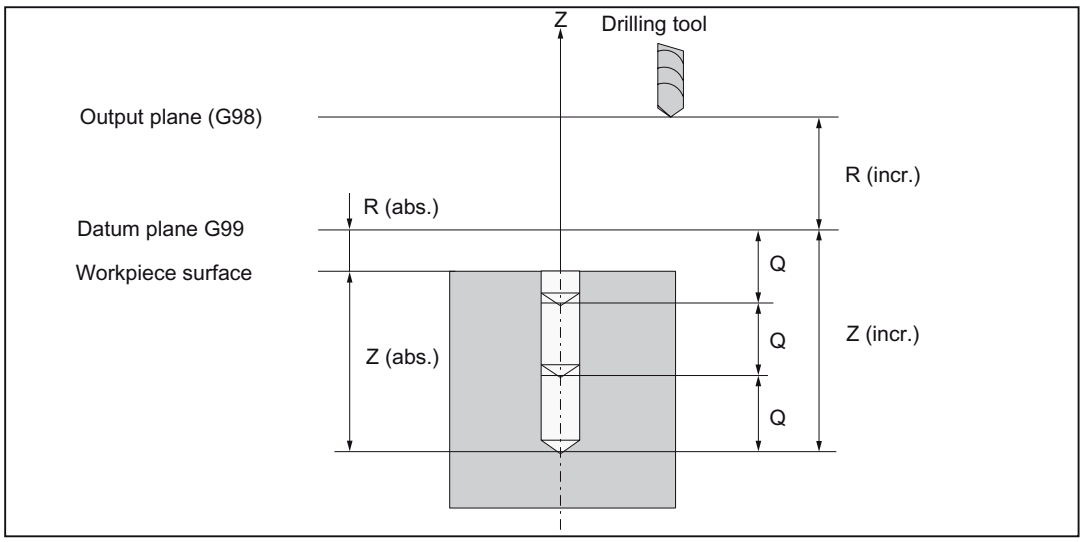


Figure 4-4 Example of deep hole drilling cycle G83 with defined plane G17. Representation of output and datum plane and parameters

4.3.2 Description of shell cycle CYCLE381M

NOTE

It is called in ISO dialect M mode using the G commands G81, G82, G85, G86, G89.

The drilling axis should be defined via GUD _ZSFI[0] (see "Global user data (GUD)" chapter).

The direction of the basis in relation to the datum plane must be identical to the direction of the datum plane in relation to the final depth.

GUD _ZSFR[0] can be used to enter a safety clearance. If the safety clearance has already been taken into account when programming the datum plane, 0 must be entered for _ZSFR[0].

If no datum plane has been programmed, drilling is undertaken from the basis (current position).

The final drilling depth must be programmed. Otherwise, an alarm is displayed.

If a feedrate is not programmed, the current feedrate is used as the drilling feedrate.

Note

Alarms are listed in the "Alarms" chap. along with alarm number and description.

4.3.3 Description of shell cycle CYCLE383M

Call

It is called in ISO dialect M mode using the G commands G73, G83.

NOTE

The drilling axis should be defined via GUD _ZSFI[0] (see "Global user data (GUD)" chapter).

The direction of the basis in relation to the datum plane must be identical to the direction of the datum plane in relation to the final depth.

GUD _ZSFR[0] can be used to enter a safety clearance. If the safety clearance has already been taken into account when programming the datum plane, 0 must be entered for _ZSFR[0].

If no datum plane has been programmed, drilling is undertaken in stages from the basis (current position).

The final drilling depth and the individual drilling depth Q must be programmed. Otherwise, an alarm is displayed.

If a feedrate is not programmed, the current feedrate is used as the drilling feedrate.

Note

Alarms are listed in the "Alarms" chap. along with alarm number and description.

Deep hole drilling with chip removal (G83)

In the standard Siemens cycle, a formula is used to determine the holding distance, i.e. it cannot be freely selected.

The system moves back to the datum plane for chip removal.

Individual drilling depth "Q":

- If there is no "Q" or if Q ≤ 0, an alarm is displayed.
- If Q > total depth, drilling is performed to the final depth.

- If Q > total depth/2, the first drilling process uses the Q value. The rest is then drilled in one drilling process.
- If Q < total depth/2, the individual drilling depth is drilled until the residual depth is < Q/2. The rest is then split into 2 infeeds of the same size.

Deep hole drilling with chip breakage

The retraction amount from chip breaking is defined with GUD _ZSFR[1].

- _ZSFR[1] > 0 Retraction amount as input
- _ZSFR[1] ≤ 0 Retraction amount is always 1 mm

Individual drilling depth "Q":

- If there is no "Q" or if Q ≤ 0, an alarm is displayed.
- If Q > total depth, drilling is performed to the final depth.
- If Q < total depth, the individual drilling depth is drilled until the residual depth is ≤ Q. The rest is then drilled in one drilling process.

4.3.4 Description of shell cycle CYCLE384M

NOTE

It is called in ISO dialect M mode using the G commands G74, G84.

The drilling axis should be defined via GUD _ZSFI[0] (see "Global user data (GUD)" chapter).

The direction of the basis in relation to the datum plane must be identical to the direction of the datum plane in relation to the final depth.

GUD _ZSFR[0] can be used to enter a safety clearance. If the safety clearance has already been taken into account when programming the datum plane, 0 must be entered for _ZSFR[0].

GUD _ZSFI[2] can be used to influence the speed when retracting.

Example: _ZSFI[2]=80, the retraction takes place at 80% of the drilling speed.

If no datum plane has been programmed, drilling is undertaken from the basis (current position).

The final drilling depth must be programmed. Otherwise, an alarm is displayed.

If a feedrate is not programmed, the current feedrate is used as the drilling feedrate.

If the drilling feedrate has been stated in mm/min (inch/min), the programmed feedrate value is converted into the appropriate revolution feedrate depending on the last speed programmed and transferred to the standard tapping cycle CYCLE84 as an incline value.

Note

Alarms are listed in the "Alarms" chap. along with alarm number and description.

4.3.5 Description of shell cycle CYCLE387M

NOTE

It is called in ISO dialect M mode using the G commands G76 and G87.

The drilling axis should be defined via GUD _ZSFI[0] (see "Global user data (GUD)" chapter).

The direction of the basis in relation to the datum plane must be identical to the direction of the datum plane in relation to the final depth.

GUD _ZSFR[0] can be used to enter a safety clearance. If the safety clearance has already been taken into account when programming the datum plane, 0 must be entered for _ZSFR[0].

The lifting path always relates to the negative direction of the first geometry axis:

For plane G17: Lifting path in -X

For plane G18: Lifting path in -Z

For plane G19: Lifting path in -Y

The angle must therefore be entered such that the tool tip points to the spindle stop in the positive direction (+) at the defined plane.

Example: Plane G17 active, then tool tip must be facing +X.

If no datum plane has been programmed, drilling is undertaken from the basis (current position).

The final drilling depth must be programmed. Otherwise, an alarm is displayed.

If a feedrate is not programmed, the current feedrate is used as the drilling feedrate.

In the absence of a programmed lifting amount, Q = 0 is set. The cycle is executed without lifting.

After retraction to the retraction plane, the tool is again moved to the center of the hole and the spindle started in the direction of rotation for processing.

Note

Alarms are listed in the "Alarms" chap. along with alarm number and description.

4.4 Turning and drilling cycles (ISO dialect T)

4.4.1 Turning cycles G70 to G76

Overview

Table 4- 5 Overview of turning cycles

G command	Description
G70	Finishing cycle
G71	Stock removal cycle, longitudinal axis
G72	Stock removal cycle transverse axis
G73	Contour repetition
G74	Deep-hole boring and grooving in the longitudinal axis (Z)
G75	Deep-hole boring and grooving in the transverse axis (X)
G76	Multiple thread cutting cycle

The cycle supply for G71 to G76 may consist of two G commands. Depending on the addresses programmed in the block, only the values of the addresses programmed in the NC block are saved so they can be used for a later cycle call or additionally to start cycle processing. Evaluation is undertaken in the shell cycle in both cases.

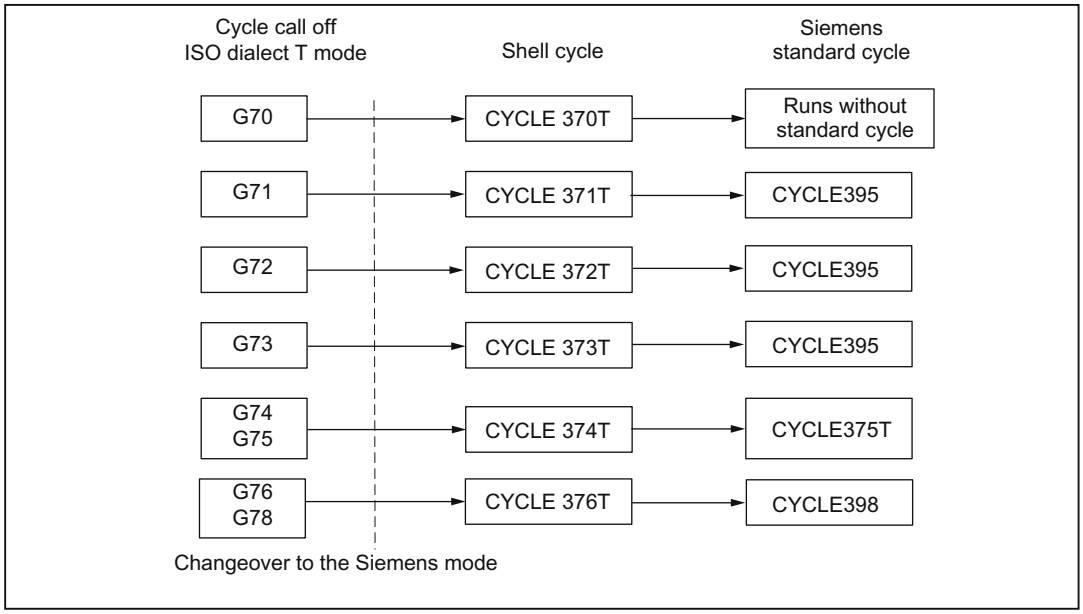


Figure 4-5 Assignment of cycle call to standard Siemens cycle in ISO dialect T mode using shell cycle

Finishing cycle G70

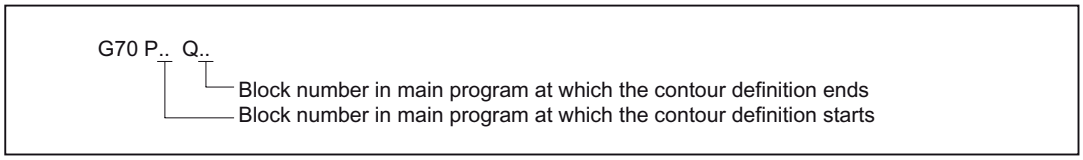


Figure 4-6 Description of permissible parameters

In ISO dialect mode, the contour is not skipped in the main program with G70. The program is always processed in the next part program block after the cycle call.

Example:

When the cycle is called, the contour N20-N50 is traversed. After the end of the cycle, the part program is processed from N20. Logically, G70 is always called after the contour description.

```
N10 G70 P20 Q50
N20 X100. Z50.
N30 X200.
N40 Z100.
N50 X250. Z111.
N60 M30
```

The blocks N20-N50 are processed once by the finishing cycle and then once again by the normal program sequence.

Stock removal cycle, longitudinal axis G71

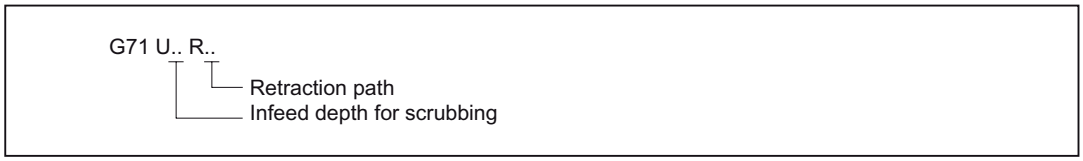


Figure 4-7 Description of permissible parameters; save values in GUDs

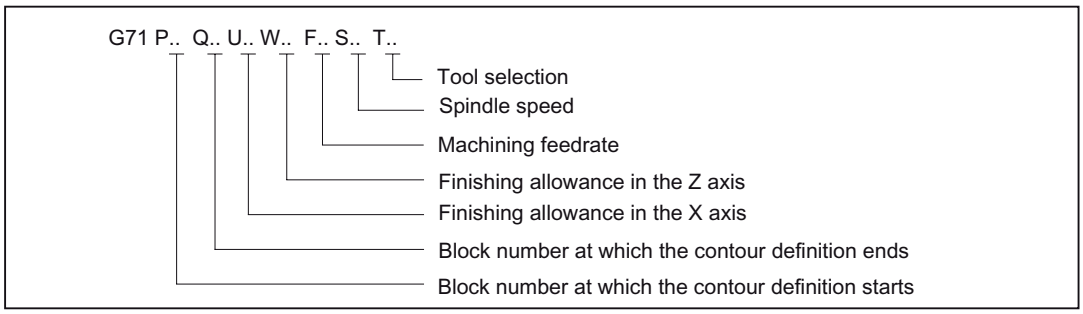


Figure 4-8 Description of permissible parameters; start cycle processing

In ISO dialect T mode with G71 the contour is traversed to the finishing allowance in the main program after scrubbing (residual corner stock removal). The program is always processed with the part program block after the last block of the contour description. Part program blocks which can be found between the cycle call and the first contour description block are not executed.

```
N10 G71 P50 Q80 U4 W3 F1000 ...
N20 G1 F0.5 G95 S1000
N30 X30. Z10.
N40 M30
N50 X100. Z50.
N60 X200.
N70 Z100.
N80 X250. Z111.
N90 M30
```

The blocks `N20-N40` are skipped and not executed. If G71 is called in the part program after the contour description, the program runs in an infinite loop. The different ways in which the part program is further processed must be taken into account in the shell cycles.

Example: G71 U6 R5 Save values in GUDs

In the example, the programmed values in the shell cycle are read from the system variables ($C_xx) and saved in channel-specific GUDs. There are separate GUDs for each cycle (G71-G76), which ensures that the programmed values remain valid until they are programmed the next time (in an NC block with G71-G76). Scenario 1 does not have to be programmed, so it makes sense to precompile the assigned GUDs.

Example: G71 P30 Q50 U3 Start cycle processing

In the example, the programmed values are only saved in system variables ($C_xx). The system variables are overwritten in each NC block in which a G function is programmed for the cycle call. For G71-G73 the processing of cycles always starts with the G command after which the "P" and "Q" addresses are programmed. Cycle processing G74-G76 is started with the G command after which addresses X/U or Z/W are programmed. F, S and T commands in the cycle's call line are also stored in system variables. The addresses do not therefore have to differ for specific cycles. The shell cycle assigns meaning to the parameters (e.g. for G76 address F = thread lead and not feedrate). For G70, feedrate, speed and tool selection commands (F, S, T) from the program part of the contour description are relevant.

The same shell cycle is always called in both scenarios.

Stock removal cycle, transverse axis G72

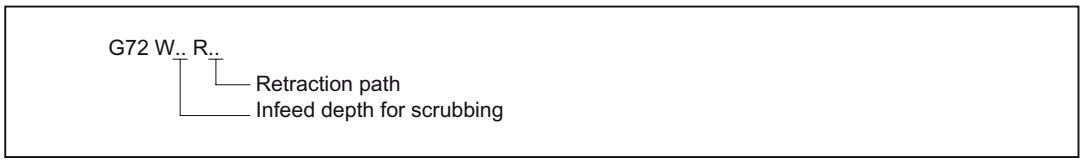


Figure 4-9 Description of permissible parameters; save values in GUDs

Contour repetition G73

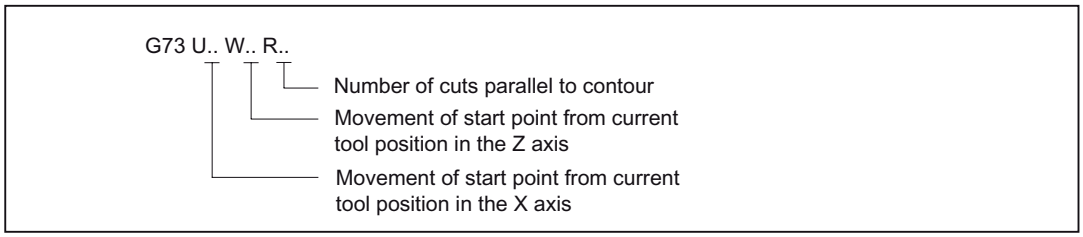


Figure 4-10 Description of permissible parameters; save values in GUDs

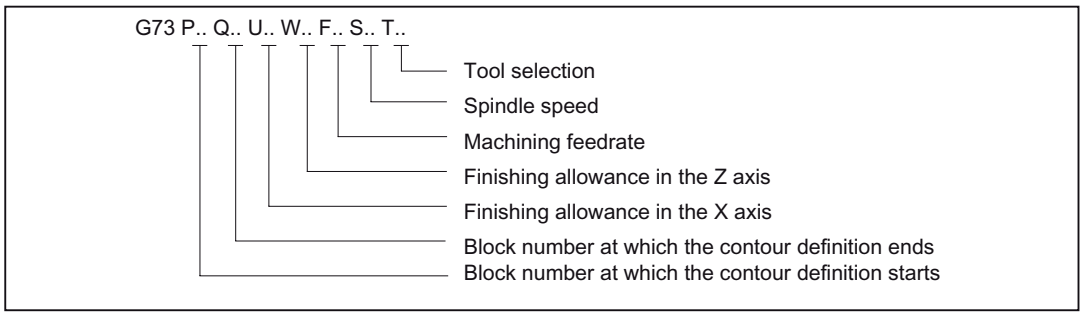


Figure 4-11 Description of permissible parameters; start cycle processing

Deep hole drilling and grooving in the longitudinal axis G74

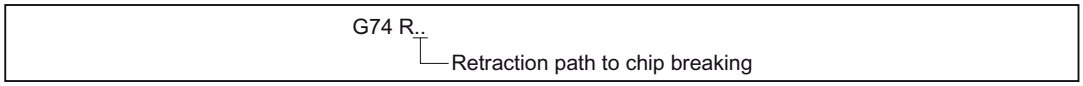


Figure 4-12 Description of permissible parameters; save values in GUDs

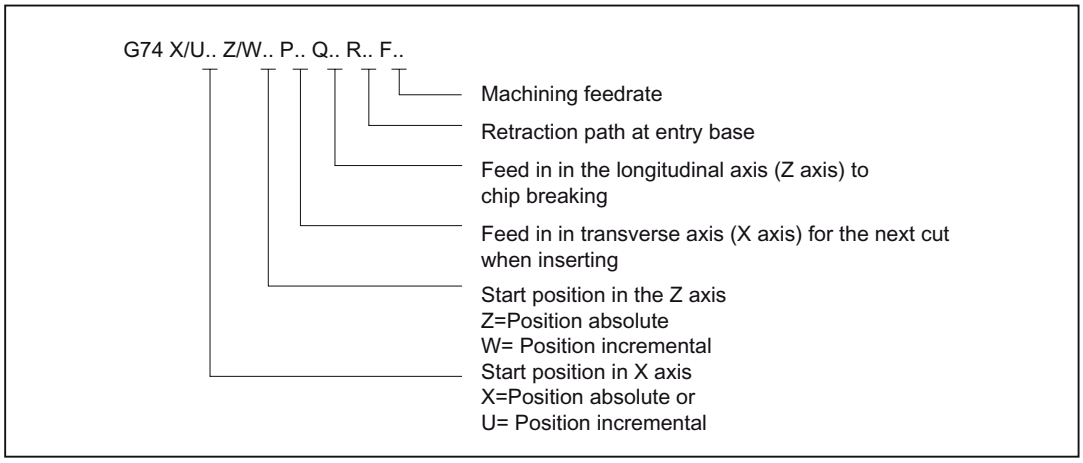


Figure 4-13 Description of permissible parameters; start cycle processing

Note

The cycle can be used as a drilling or cut-in cycle. If the cycle is used for drilling, the addresses X/U and P cannot be used.

Deep hole drilling and grooving in the transverse axis G75

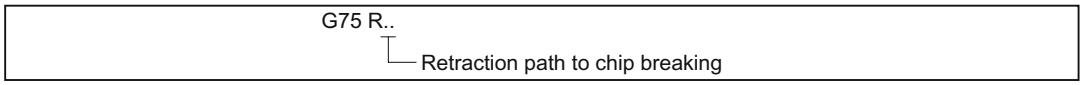


Figure 4-14 Description of permissible parameters; save values in GUDs

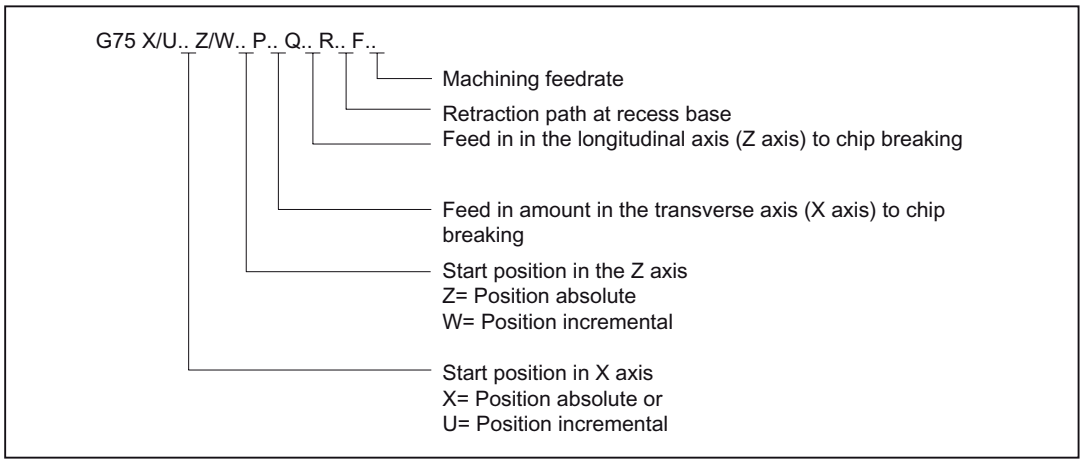


Figure 4-15 Description of permissible parameters; start cycle processing

Note

The cycle can be used as a drilling or cut-in cycle. If the cycle is used for drilling, the addresses Z/W and Q cannot be used.

Multiple thread cutting cycle G76

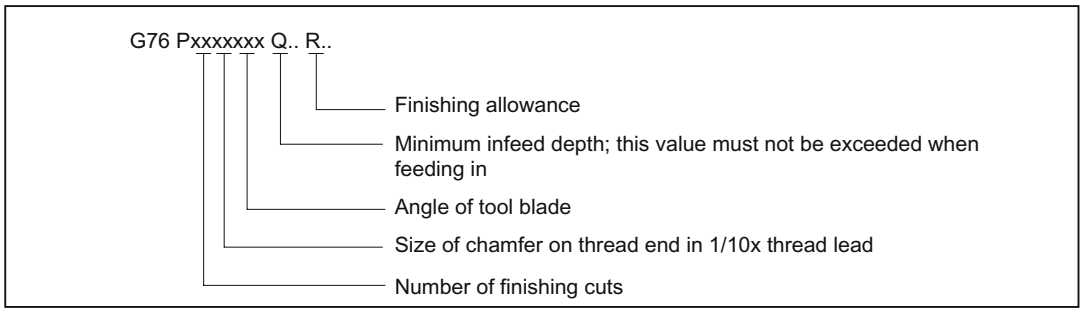


Figure 4-16 Description of permissible parameters; save values in GUDs

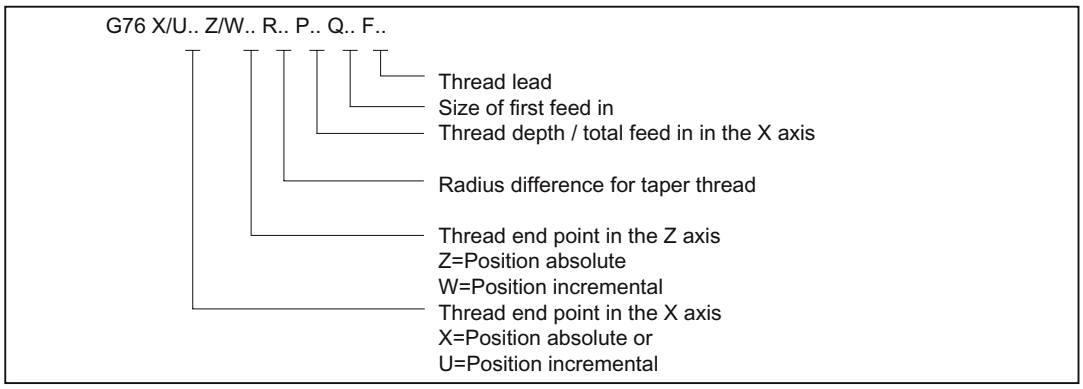
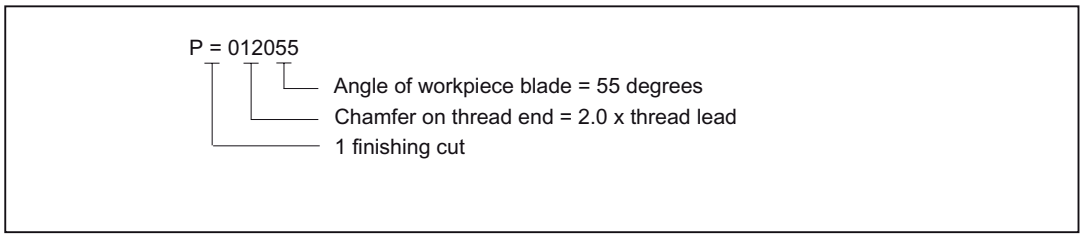


Figure 4-17 Description of permissible parameters; start cycle processing

Example for address P:

G76 P012055 Q4 R0.5



4.4.2 Turning cycles G77 to G79

Overview

Table 4- 6 Overview of turning cycles G77 to G79

G command	Description
G77	Lengthwise stock removal
G78	Thread cutting
G79	Transverse stock removal

These cycle calls are modally effective and are called in each NC block with axial motion.
The processing movements are defined in the call parameters after the G function.
The following parameters are permitted in NC blocks with cycle calls using G77 to G79:

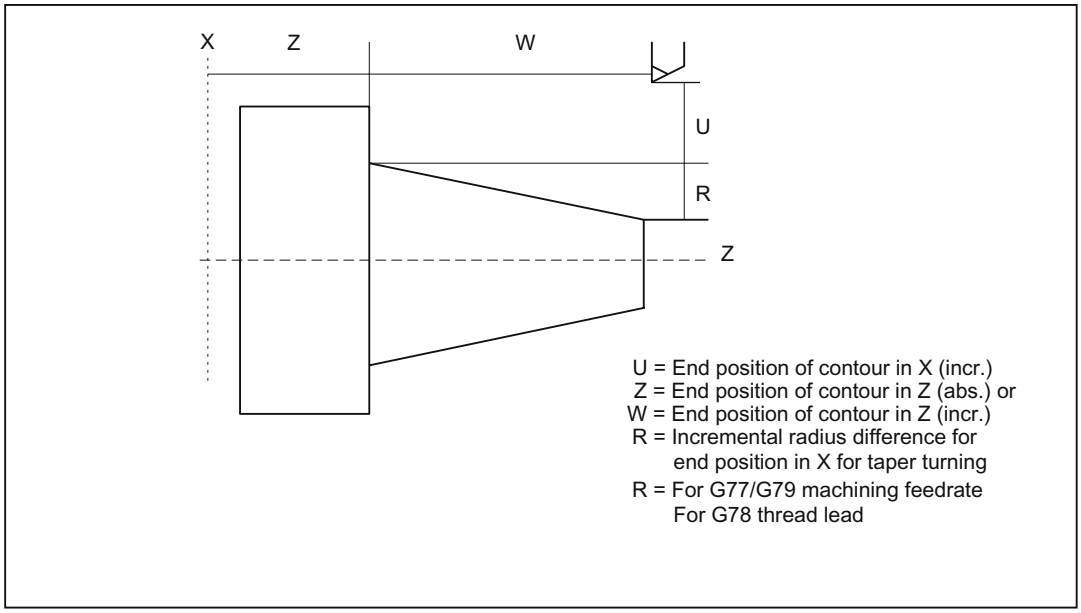


Figure 4-18 Parameters for cycle calls using G77 to G79

Lengthwise stock removal G77

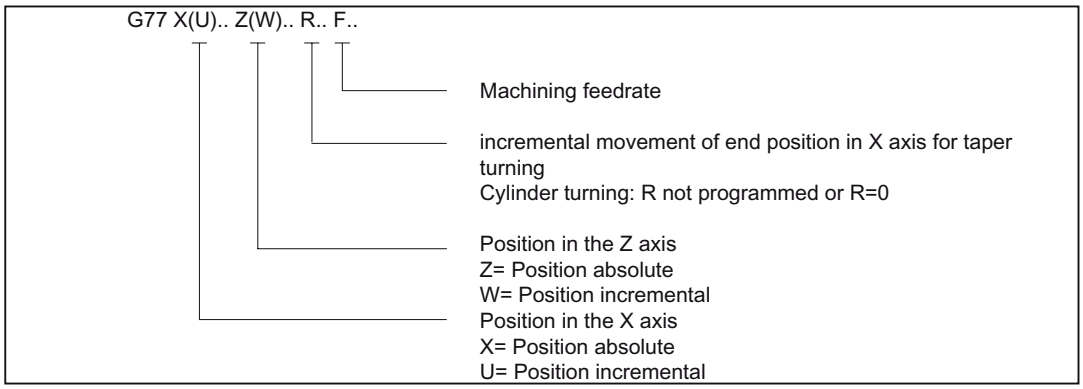


Figure 4-19 Description of permissible parameters; start cycle processing

Thread cutting G78

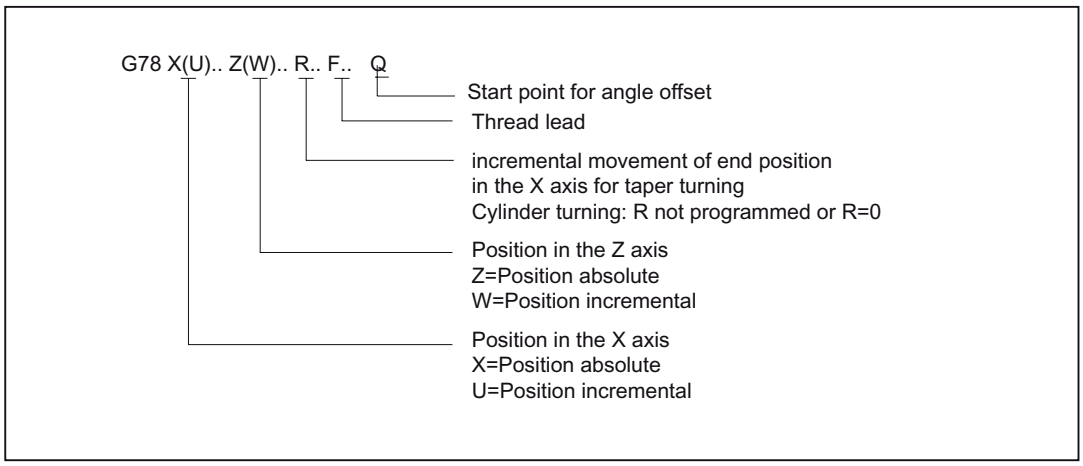


Figure 4-20 Description of permissible parameters; start cycle processing

Transverse stock removal G79

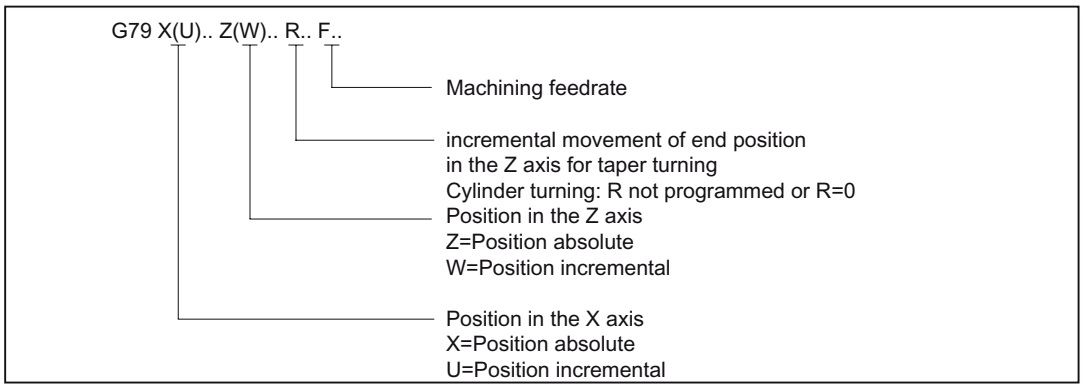


Figure 4-21 Description of permissible parameters; start cycle processing

4.4.3 Drilling cycles G80 to G89

Overview

With fixed cycles for hole-machining specific movements can be programmed for machining the drill holes, which normally require several command frames made of several single-block commands. The program called with the fixed cycle can be deselected again with G80.

The G functions used for calling the fixed cycles G80 to G89 are the same for all G code systems.

Table 4- 7 Overview of drilling cycles

G command	Description
G80	Drilling cycle off
G83	Front face deep hole drilling
G84	Front face tapping
G85	Front face drilling
G87	Side surface deep hole drilling
G88	Side surface tapping
G89	Side surface drilling

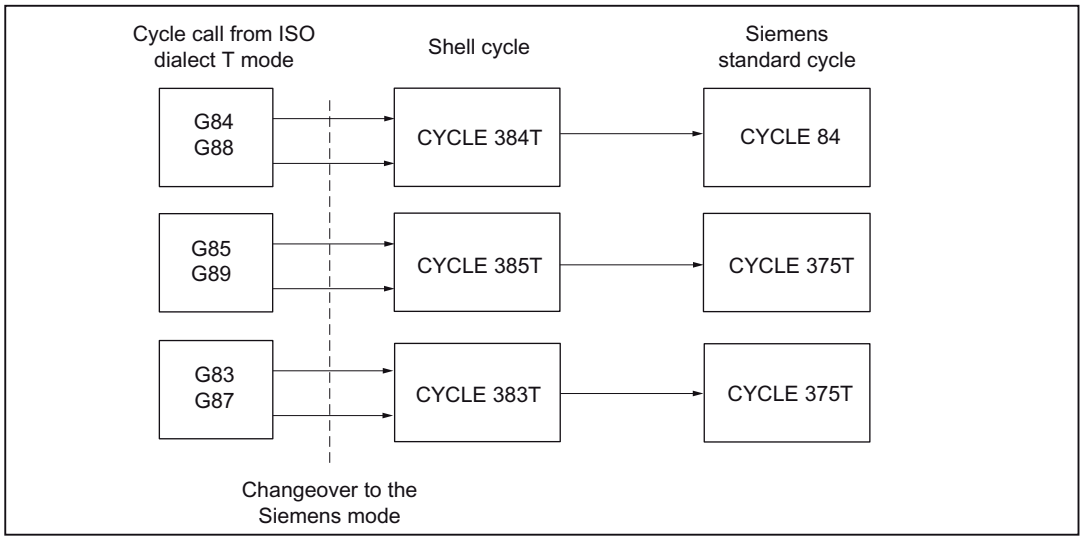


Figure 4-22 Assignment of drilling cycles to standard Siemens cycle in ISO dialect T mode using shell cycle

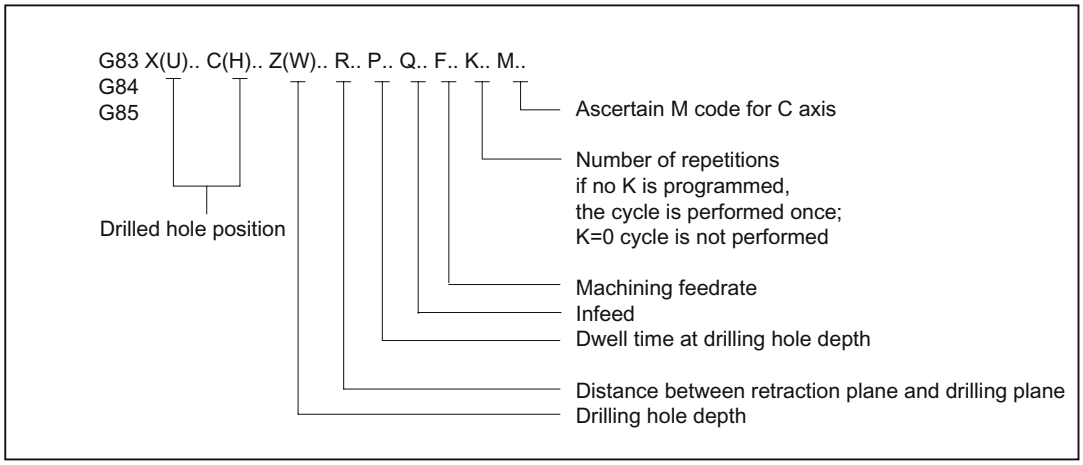


Figure 4-23 Description of permissible parameters; start cycle processing

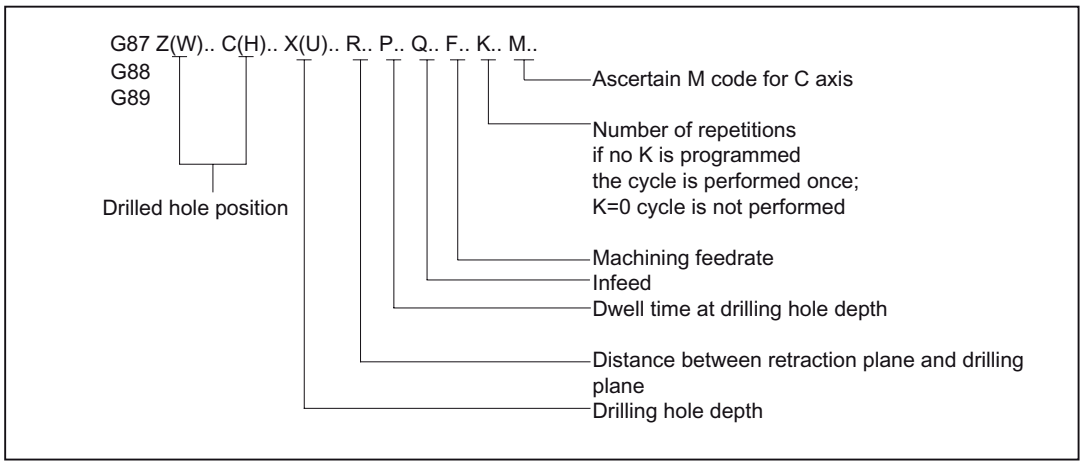


Figure 4-24 Description of permissible parameters; start cycle processing

The drilling cycles are modally effective and are executed in every NC block in which axial movements of axes X, C, Z are programmed. When a drilling mode is active, only the new parameters have to be programmed if a parameter is changed. The parameters are stored in the system variables $C_xx (xx = NC address) which are read by the cycles.

If there is a G function of the 1st G group in the same NC block after the cycle G function, the cycle is not executed. Only the axes programmed in the NC block are traversed. Addresses R, Q, P, K are not written to the system variables. The feedrate programmed in this block is activated.

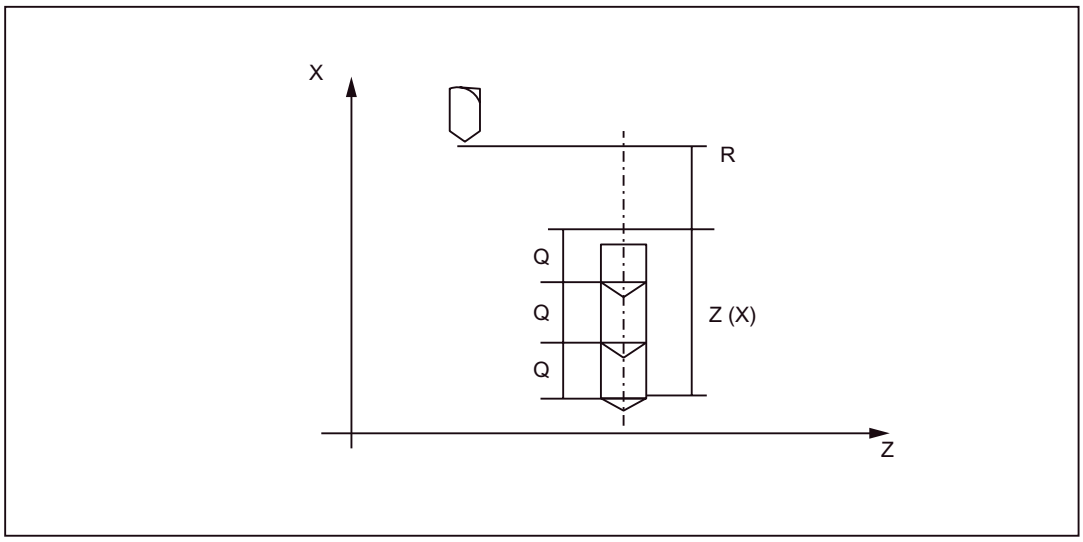


Figure 4-25 Drilling cycle

Modal cycles

All modal cycles are deselected in ISO dialect mode with G80 or with a G function of the 1st group (G00-G03, G33, G34, apart from G77-G79).

Cycle parameters can be programmed in the following blocks while a modal cycle is active. These parameters are written to the system variables so that the shell cycle works with the modified parameters.

Example:

```
N10 G81 X10. Z15. R5 Q4 P10 F1000
N20 X50.  ;drilling cycle at position X50
```

4.4.4 Description of shell cycle CYCLE383T

It is called in ISO dialect T mode using the G commands G83 and G87.

Note

The direction of the basis in relation to the datum plane must be identical to the direction of the datum plane in relation to the final depth. Otherwise the Siemens drilling cycle results in an error message.

In ISO dialect T, the programmer must take into account the safety clearance when defining the datum plane. For Siemens the safety clearance from the R plane can be stated separately.

This option has also been realized in ISO cycles. GUD_ZSFR[20] can be used to enter a safety clearance if necessary. If the safety clearance has already been taken into account when programming the R plane, "ZERO" must be entered for GUD_ZSFR[20].

GUD_ZSFR[23] is used to determine whether the dwell time (for deep hole drilling only) is to be undertaken in seconds or revolutions for G95.

A shell cycle may only be called by an external G code (G83/G87). Calling in Siemens mode (after switching over with G290 and CYCLE383T call) is not permitted.

If the G83/G87 block contains axis names other than X/Z (U/W), alarm (61811) "ISO axis name not permitted" occurs.

GUD_ZSFR[2] is used to determine whether the cycle is to be executed with chip breaking or chip removal.

With ISO dialect, the constant individual depth is retained until the remainder at the base of the hole is removed with an infeed. With Siemens the remainder (less than 2*individual depth) at the base of the hole is split into two infeeds of the same size if necessary.

Note

Alarms are listed in the "Alarms" chap. along with alarm number and description.

4.4.5 Description of shell cycle CYCLE384T

It is called in ISO dialect T mode using the G commands G84 and G88.

Note

The direction of the basis in relation to the datum plane must be identical to the direction of the datum plane in relation to the final depth. Otherwise the Siemens drilling cycle results in an error message. ISO dialect has no monitoring here.

In ISO dialect T, the programmer must take into account the safety clearance when defining the datum plane. For Siemens the safety clearance from the R plane can be stated separately.

This option has also been realized in ISO cycles. GUD_ZSFR[20] can be used to enter a safety clearance if necessary. If the safety clearance has already been taken into account when programming the R plane, "ZERO" must be entered for GUD_ZSFR[20].

A shell cycle may only be called by an external G code (G84/G88). Calling in Siemens mode (after switching over with G290 and CYCLE384T call) is not permitted.

If the G84/G88 block contains axis names other than X/Z (U/W), alarm (61811) "ISO axis name not permitted" occurs.

GUD_ZSFI[22] (value as %) can be used to influence the speed of drilling when retracting.

Example: ZSFI[22]=95 Retraction takes place at 95% of the hole depth.

Note

Alarms are listed in the "Alarms" chap. along with alarm number and description.

4.4.6 Description of shell cycle CYCLE385T

It is called in ISO dialect T mode using the G commands G85 and G89.

Note

The direction of the basis in relation to the datum plane must be identical to the direction of the datum plane in relation to the final depth. Otherwise the Siemens drilling cycle results in an error message. ISO dialect has no monitoring here.

In ISO dialect T, the programmer must take into account the safety clearance when defining the datum plane. For Siemens the safety clearance from the R plane can be stated separately.

This option has also been realized in ISO cycles. GUD_ZSFR[20] can be used to enter a safety clearance if necessary. If the safety clearance has already been taken into account when programming the R plane, "ZERO" must be entered for GUD_ZSFR[20].

A shell cycle may only be called by an external G code (G85/G89). Calling in Siemens mode (after switching over with G290 and CYCLE385T call) is not permitted.

If the G85/89 block contains axis names other than X/Z (U/W), alarm (61811) "ISO axis name not permitted" occurs.

If the G84 block contains axis names other than X/Z (U/W), alarm (61811) "ISO axis name not permitted" occurs.

Note

Alarms are listed in the "Alarms" chap. along with alarm number and description.

4.5 System variables

The names of the system variables all start with $C_ xx. The NC address, the value of which is stored in the system variables, can be found in the name extension xx. Variable $C_G always contains the G number with which a cycle has been called.

Bit 0 is set in the $C_x_PROG system variables for all programmed addresses if the address is programmed.

Bit 1 is also set in the $C_x_PROG variables for axis addresses programmed incrementally.

At the subprogram end (M17, RET), $C_x_PROG is set to FALSE.

Example 1:

```
N10 G01 G81 X100. Z-50. R20 F100
```

Shell cycle CYCLE381M for G81 is called automatically. The calculations are carried out in the shell cycle and the standard Siemens cycle CYCLE82 then called. The G01 command is not needed.

The values of the programmed addresses are written to the system variables:

Address X is written to system variable $C_X;
Address Z is written to system variable $C_Z;
Address R is written to system variable $C_R;
Address F is written to system variable $C_F;

Example 2:

Axis Z is programmed in an incremental manner (G91) → $C_Z_PROG =3
Axis Z is programmed in an absolute manner (G90) → $C_Z_PROG =1

Example 3: Siemens shell cycle for Gxy

```
N10 PROC CYCLE377 DISPLOF                 ;block display remains G77 block,
                                          ;freeze G code display
N20 DEF REAL DELTA_X, pos_X, pos_Z, FEEDRATE
N30 DEF BOOL R_prog, X_prog, Z_prog
N50 DELTA_X = 0
N60 IF $C_R_PROG                          ;only load DELTA_X if
N70 DELTA_X = $C_R                        ;address R has been programmed
N75 ENDIF
N110 CYCLE...(DELTA_X, $C_X, $C_Z,        ;call Siemens cycle
$C_R_PROG, $C_X_PROG, $C_Z_PROG, $C_F)
N230 RET                                  ;shell cycle end
```

Table 4- 8 List and description of system variables

Identifier	Type	Description
$C_A	REAL	Value of programmed address A in ISO dialect mode for cycle programming
$C_B	REAL	Value of programmed address B in ISO-dialect-mode for cycle programming
....	....	.....
$C_G	INT	G number for cycle calls in external mode
$C_H	REAL	Value of programmed address H in ISO dialect mode for cycle programming
$C_I[ ]	REAL	Value of the programmed Address I in ISO dialect mode for cycle programming and macro technology with G65/G66. A max. of 10 entries is possible in the block for the macro programming. The values remain in the programmed sequence in the array.
$C_I_ORDER[ ]	REAL	For description, refer to $C_I[ ], defines the programming sequence
$C_J[ ]	REAL	For description refer to $C_I[ ]
$C_J_ORDER[ ]	REAL	For description, refer to $C_I[ ], defines the programming sequence
$C_K[ ]	REAL	For description refer to $C_I[ ]
$C_K_ORDER[ ]	REAL	For description, refer to $C_I[ ], defines the programming sequence
$C_L	REAL	Value of programmed address L in ISO dialect mode for cycle programming
....	....	....
$C_Z	REAL	Value of programmed address Z in ISO dialect mode for cycle programming

Identifier	Type	Description
$C_TS	STRING	String of tool identifier programmed under the address T
$C_A_PROG	INT	Address A is programmed in a block with cycle call. 0 = Not programmed 1 = Programmed (absolute) 3 = Programmed (incremental)
$C_B_PROG	INT	Address B is programmed in a block with cycle call. 0 = Not programmed 1 = Programmed (absolute) 3 = Programmed (incremental)
....	....	....
$C_G_PROG	INT	The shell cycle is programmed over a G function
$C_Z_PROG	INT	Address Z is programmed in a block with cycle call. 0 = Not programmed 1 = Programmed (absolute) 3 = Programmed (incremental)
$C_TS_PROG	INT	A tool identifier was programmed under address T TRUE = programmed; FALSE = not programmed
$C_ALL_PROG	INT	Bit pattern of all programmed addresses in a block with cycle call Bit 0 = Address A Bit 25 = Address Z Bit = 1 address is programmed Bit = 0 address is not programmed
$P_EXTGG[n]	INT	Active G code of the external language
$C_INC_PROG	INT	Bit pattern of all incrementally programmed addresses in a block with cycle call Bit 0 = Address A Bit 25 = Address Z Bit = 1 address is programmed incrementally Bit = 0 address is not programmed as absolute
$C_I_NUM	INT	Cycle programming: Value is always 1 if bit 0 is set in $C_I_PROG. Macro programming: Number of address I programmed in the block (max. 10).
$C_J_NUM	INT	For description refer to $C_I_NUM
$C_K_NUM	INT	For description refer to $C_I_NUM
$P_AP	INT	Polar coordinates 0=OFF 1=ON
$C_TYP_PROG	INT	Bit pattern of all programmed addresses in a block with cycle call Bit 0 = A Bit 25 = Z Bit = 0 Axis is programmed as INT Bit = 1 Axis is programmed as REAL
$C_PI	INT	Program no. of the interrupt routine that was programmed with M96

4.6 Programming contour definitions (ISO dialect T)

Overview

Contour definitions can be programmed in both ISO dialect T mode and Siemens mode.

There are 3 basic forms of contour definitions:

- One straight line

  End point is programmed with a Cartesian coordinate and an angle
- Two straight lines

  Transition with a curve or chamfer
- Three straight lines

  Transitions with a curve or chamfer

In the descriptions that follow, the address letters X, Z, A, R and C sometimes have indices to allow for clear assignment between NC block and the associated drawing. These indices do not appear in the NC program. The assignment always clearly results from the block containing an address letter. Address letter Q is a filler at places where either R or C may occur. Q may also not be used. In such cases, no chamfer or curve is inserted at the transition of the two straight lines.

Any other NC addresses can be used, e.g. address letters for other axes (single axes or axis perpendicular to the machining plane), auxiliary function specifications, G codes, velocities, etc. in the blocks that describe contour definitions.

It is assumed that G18 is active in the following examples. However, the programming of contour definitions is also possible without restrictions with G17 or G19.

ISO dialect mode

Address C is used in ISO dialect mode as both an axis identifier and as an identifier for a chamfer in the contour definition.

Address R can either be a cycle parameter or an identifier for the radius in a contour definition.

To distinguish between the two, a "," must be set before address C or R when programming the contour definition (as with ISO dialect). If an angle is programmed before C or R, a comma does not have to be programmed before it. If radius and chamfer are programmed together in a block, e.g. N333 X100 A10 C20 R15, regardless of the programming sequence a radius is always inserted in the contour. The chamfer is ignored.

Siemens mode

In Siemens mode, the identifiers for angle, radius and chamfer are defined via machine data. This avoids name conflicts. A comma must not be programmed before the identifier for radius or chamfer.

Note

MD10652 for angle: $MN_CONTOUR_DEF_ANGLE_NAME
MD10654 for radius: $MN_RADIUS_NAME
MD10656 for chamfer: $MN_CHAMFER_NAME
(only applies in Siemens mode and not with SINUMERIK 802D sl)

4.6.1 End point programming with angles

If the address letter A appears in an NC block, either none, one or both of the axes in the active plane may also be programmed.

If no axis of the active plane has been programmed, then this is either the first or second block of a contour definition consisting of two blocks. If this is the second block of such a contour definition, the start and end point in the active plane are identical. The contour definition then consists only of a motion perpendicular to the active plane.

If exactly one axis of the active plane has been programmed, then this is either a single straight line whose end point can be clearly defined via the angle and programmed Cartesian coordinate or the second block of a contour definition consisting of two blocks. In the second case, the missing coordinate is set to the same as the last (modal) position reached.

If two axes of the active plane have been programmed, then this is the second block of a contour definition consisting of two blocks. If the current block has not been preceded by a block with angle programming without programmed axes of the active plane, then this block is not permitted.

Angle A may only be programmed for linear or spline interpolation. (Spline interpolation in Siemens mode only.)

Alarms are generated in the following cases:

- With a contour definition consisting of two blocks, at the transition to the second block, the active plane is changed.
- With the angles programmed, a valid intermediate point cannot be formed for a contour definition consisting of two straight lines.
- In a block with address A, neither linear nor spline interpolation is active.
- A block with address A without a programmed axis in the active plane is not followed by a block which can be used to determine the end point of the contour definition. This is the case if this block is the last in a program or if the following block contains a preprocessing stop.
- No angle has been programmed in the second block of a contour definition consisting of two straight lines.
- Both axes of the active plane are programmed in a block with address A, which is not the second block of a contour definition consisting of two straight lines.
- Programmed Cartesian coordinates and programmed angles are incompatible.

4.6.2 Straight line with angle

The end point is defined by stating angle A and one of the two coordinates X_2 or Z_2.

Programming syntax:

X_2.. A.. or

Z_2.. A..

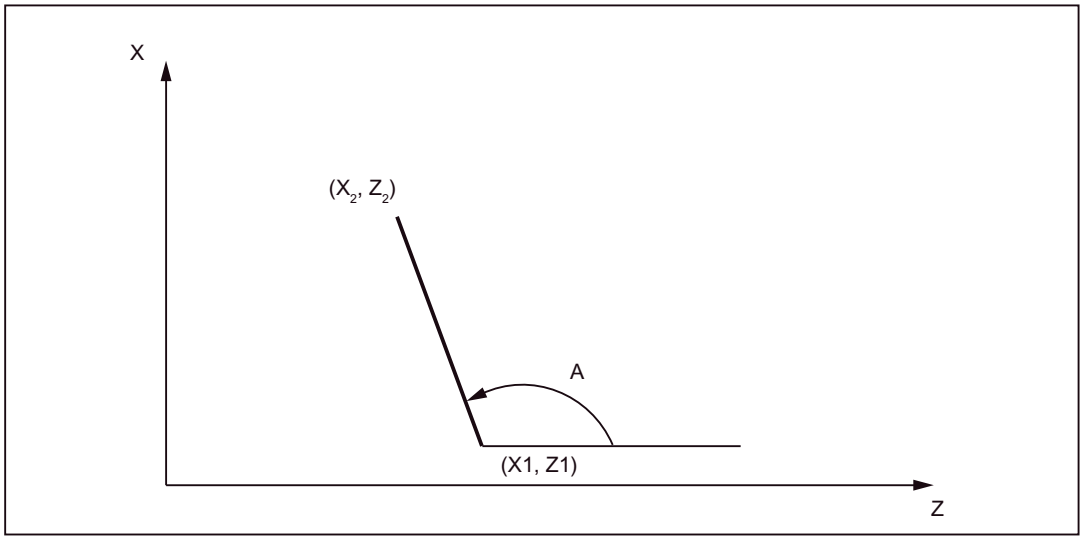


Figure 4-26 Straight line with angle

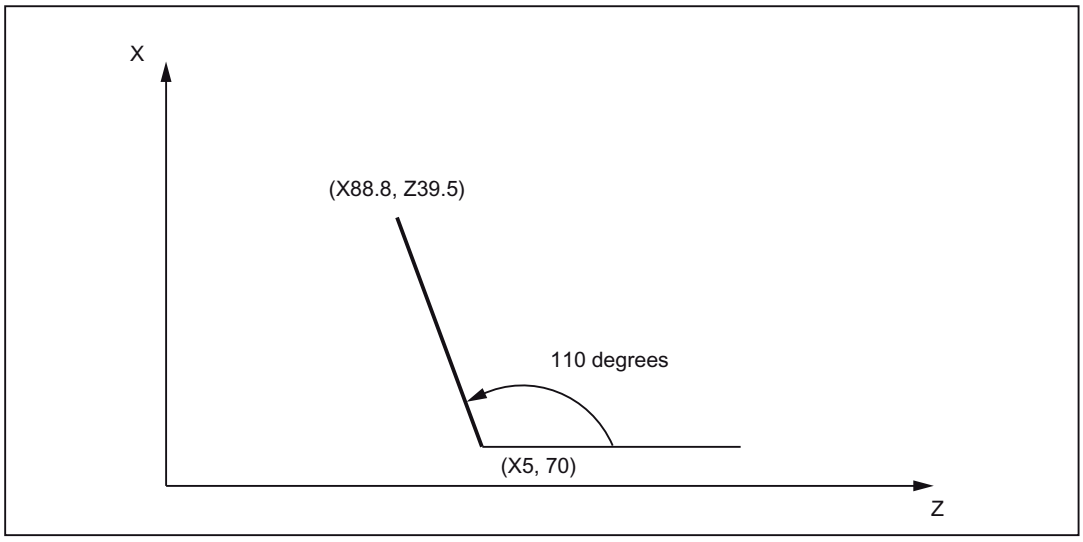


Figure 4-27 Straight line with angle

Example (previous figure):

Programming in ISO dialect T mode:

```
N10 G1 X5. Z70. F1000 G18
N20 X88.8 A110 or (Z39.5 A110)
```

Programming in Siemens mode:

```
N10 X5. Z70. F1000 G18
N20 X88.8 ANG=110 or (Z39.5 ANG=110)
```

4.6.3 Two straight lines

The end point of the first straight line can be programmed by specifying the Cartesian coordinates or by specifying the angle of the two straight lines relative to the x coordinate.

Programming syntax:

```
N10 A1.. (Q..)
N20 X3.. Z3.. A2..
```

or

```
N10 X1.. Z1.. (Q..)
N20 X3.. Z3..
```

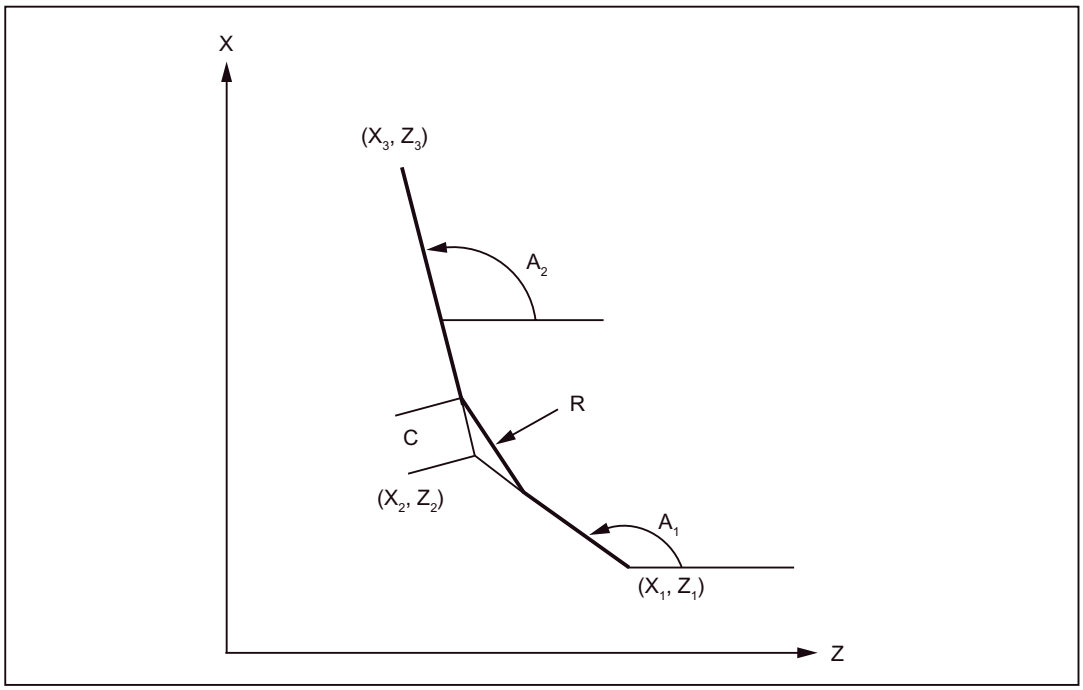


Figure 4-28 Two straight lines

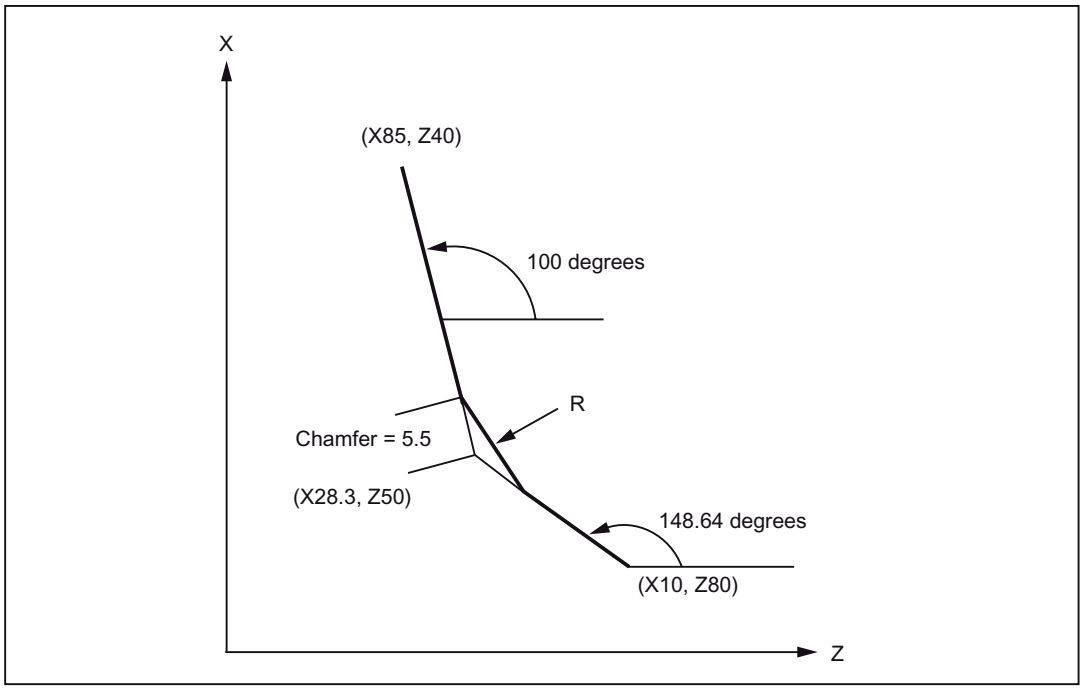


Figure 4-29 Two straight lines

Example (previous figure):

Programming in ISO dialect T mode:

```
N10 G1 X10. Z80. F1000 G18
N20 A 148.64 C55
N30 X85. Z40. A100
```

Programming in Siemens mode:

```
N10 X10. Z80. F1000 G18
N20 ANG=148.65 CHR=5.5
N30 X85. Z40. ANG=100
```

4.6.4 Three straight lines

The end point of the third straight line must always be programmed with Cartesian coordinates. The transition from the second to the third coordinate can either take the form of a chamfer or radius.

This type of programming can be continued for any number of blocks, i.e. a distinction does not have to be made between contour definitions with two or more blocks.

Programming syntax:

```
N10 X2.. Z2.. (Q1..)
N20 X3.. Z3.. (Q2..)
```

```
N30 X4.. Z4..
```

or

```
N10 A1.. (Q1..)
N20 X3.. Z3.. A2.. (Q2..)
N30 X4.. Z4..
```

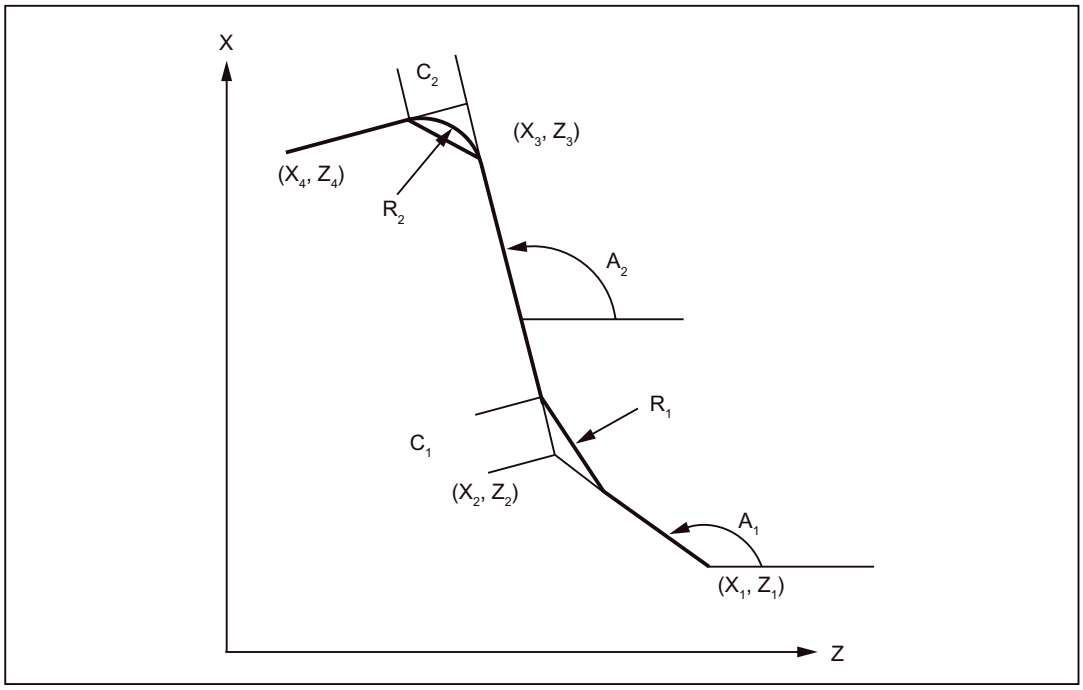


Figure 4-30 Three straight lines

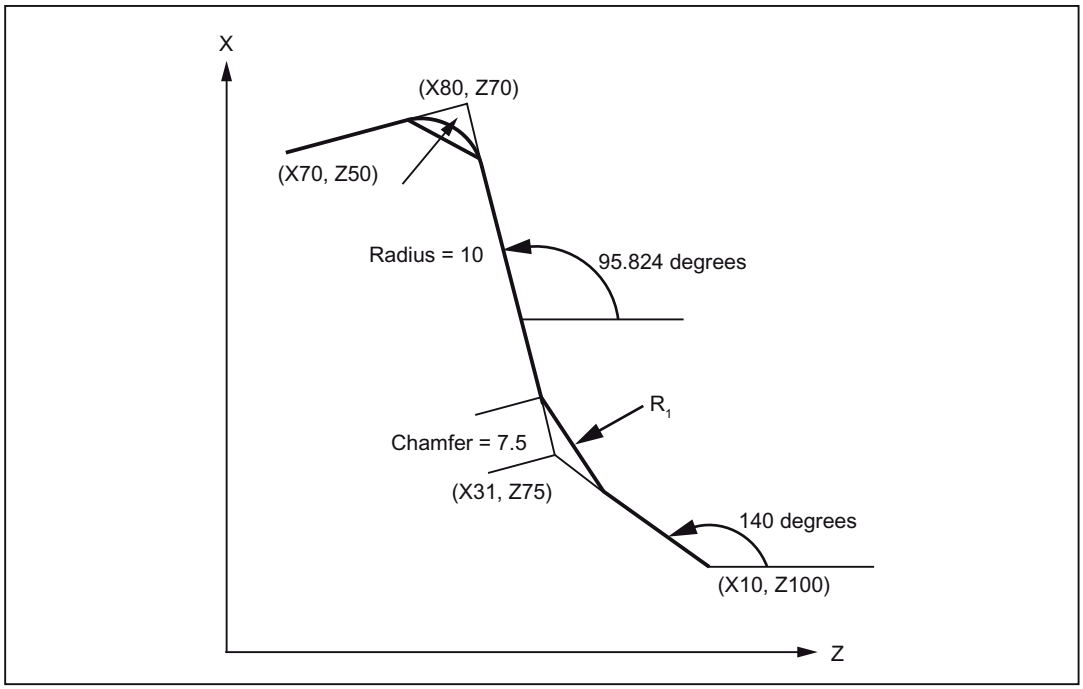


Figure 4-31 Three straight lines

Example (previous figure):

Programming in ISO DIALECT T mode:

```
N10 G1 X10. Z100. F1000 G18
N20 A140 C7.5
N30 X80. Z70. A95.824, R10
```

Programming in Siemens mode:

```
N10 X10. Z100. F1000 G18
N20 ANG=140 CHR=7.5
N30 X80. Z70. ANG=95.824 RND=10
N40 X70 Z50
```

4.6.5 Multi-edge turning with G51.2

Function

Does not function in SINUMERIK 802D sl.

With the G51.2 function, workpieces with multiple edges can be produced by coupling two spindles. This corresponds to the synchronous spindle function in Siemens mode with a transformation ratio other than 1 : 1.

With the programming syntax G51.2 Q.. P.. R.. the synchronous spindle coupling is activated. The transformation ratio from leading spindle to the following spindle is defined with the parameters "Q" and "P". If the coupling is to be activated with an angular offset from following spindle and leading axis, the angular difference is programmed with the address "R".

When mapping the function to Siemens language, in order to activate the synchronous spindle function, two part program commands must always be issued - these must not occur in the same block.

The assignment of leading and following spindle and the transformation ratio (and type of coupling) are defined with a part program command (COUPDEF(..)). The second part program command activates the coupling with the angle offset programmed (COUPON(..)). To execute the two program commands, a cycle is called with G51.2 (CYCLE3512). The programmed values are transferred to cycle parameters $C_P, $C_Q and $C_R. G50.2 is used to deactivate the coupling again (also with CYCLE3512).

With the programming of G51.2, the 1st spindle in the channel is always defined as the leading spindle and the 2nd spindle as the following spindle. Setpoint linkage is selected as the type of coupling.

Example

```
N10 T1234
N20 G0 X10 Z100 M3 S1000
N30 G51.2 P1 Q3                         ;start synchronous spindle with
                                        ;transformation ratio 1 : 3
                                        ;and angle offset of 0 degrees
Nxx ....
N1000 G51.2 R180                        ;angle offset between leading and
                                        ;following spindle of 180 degrees
N1200 G50.2                             ;switch off synchronous spindle operation
N2000 M30
```

For a detailed description of the synchronous spindle function, see

Function Manual for extended functions, chapter M1 and
Programming Manual Job Planning, chapter "Synchronous spindle".

4.6.6 Contour repetition G72.1/G72.2

Function

Does not function in SINUMERIK 802D sl.

G72.x is used to call a subprogram programmed under address P... The number of subprogram repetitions is defined with address L. If address L is not programmed, the subprogram is executed once. Depending on the G code, a coordinate rotation is executed (G72.1) or an incremental distance traversed, relative to the contour's start point, before every subprogram call (G72.2).

G72.1

G72.1 is used to call a subprogram (in which the contour to be repeated is programmed) several times. The coordinate system is rotated by a certain angle before each subprogram call.

This function is realized by calling a cycle (CYCLE3721). The programmed values in cycle parameters $C_.. are transferred to the cycle. The G function number can be found in $C_G, a value of 721 is entered for G72.1 and 722 for G72.2 in $C_G. The cycle carries out the coordinate rotation n times and calls the subprogram n times. The coordinate rotation is executed around a vertical axis on the selected plane.

`X.. Y.. (Z..)`	`Reference point for coordinate rotation`
`P..`	`Subprogram number`
`L..`	`Number of subprogram repeats`
`R..`	`Angle of rotation`

Example:

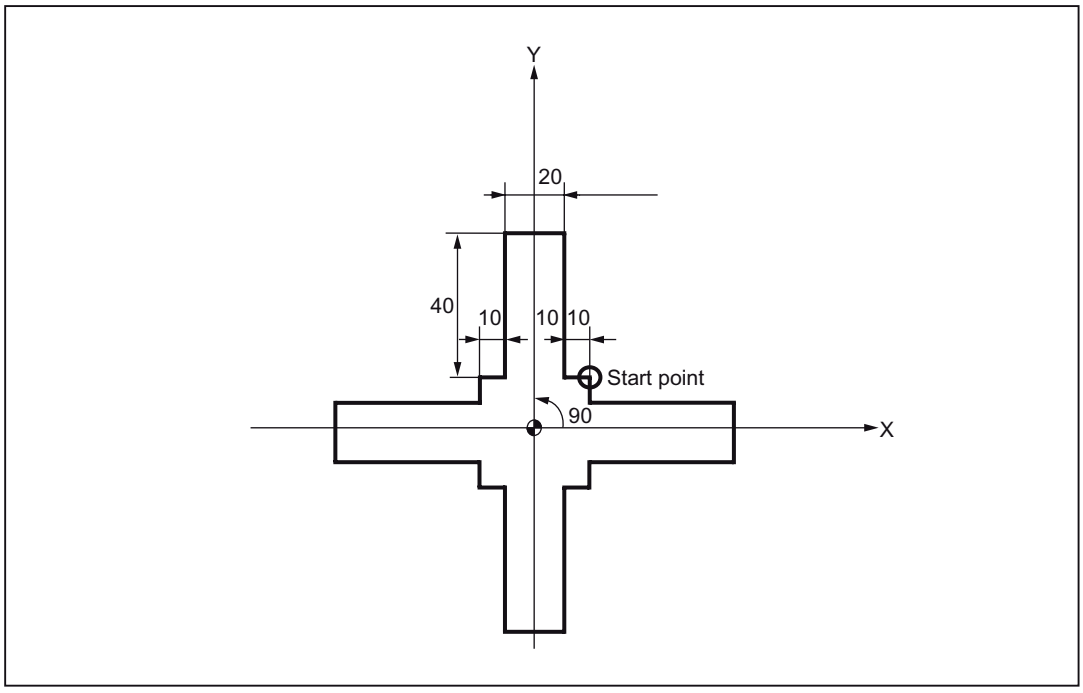


Figure 4-32 Contour repetition with G72.1

Main program

```
N10 G92 X40.0 Y50.0 ;
N20 G01 G90 G17 G41 20 Y20 D01 F1000
N30 G72.1 P1234 L4 X0 Y0 R90.0
N40 G40 G01 X100 Y50 Z0
N50 G00 X40.0 Y50.0 ;
N60 M30 ;
```

Subprogram 1234.spf

```
N100 G01 X10
N200 Y50
N300 X-10
N400 Y10
N500 X-20
N600 M99
```

G72.2

G72.2 is used to call a subprogram (in which the contour to be repeated is programmed) several times. The axes programmed with I, J and K are traversed incrementally before each subprogram call. In CYCLE3721 the programmed G function recognizes whether the contour subprogram is repeated after a rotation or a linear movement.

This function is realized by calling a cycle. The programmed values in cycle parameters $C_.. are transferred to the cycle. The cycle calls the subprogram n times. A distance programmed under I, J, K is traversed incrementally (calculated from the start point) before each subprogram call.

I.. J.. K..	Position to which the X, Y Z axes are traversed before calling the subprogram. The position relates to the start point of the subprogram.
P..	Subprogram number
L..	Number of subprogram repeats

Example:

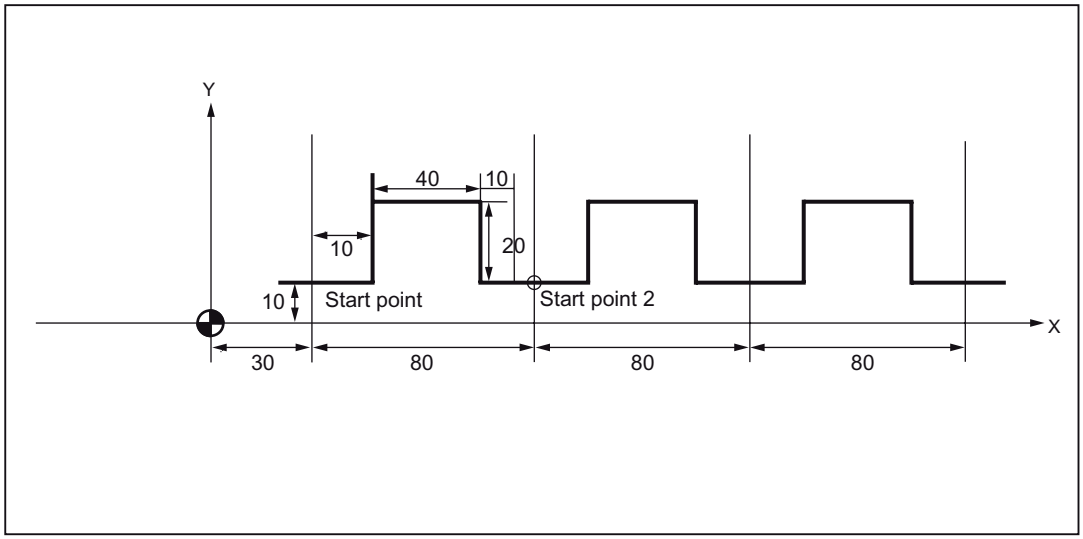


Figure 4-33 Contour repetition with G72.2

```
N10 G00 G90 X0 Y0
N20 G01 G17 G41 X30. Y0 D01 F1000
N30 Y10.
N40 X30.
N50 G72.2 P2000 L3 I80. J0

O2000 G90 G01 X40.
N100 Y30.
N200 G01 X80.
N300 G01 Y10.
N400 X90.
N500 M99
```

Commissioning

5

5.1 Machine data

Activating ISO dialect mode

MD18800 $MN_MM_EXTERN_LANGUAGE

Selection of ISO dialect M or T

MD10880 $MN_MM_EXTERN_CNC_SYSTEM=1: ISO dialect M

MD10880 $MN_MM_EXTERN_CNC_SYSTEM=2: ISO dialect T

ISO dialect T axis names

The maximum number of axes is 8. The axis identifiers of the first 2 axes are fixed X, Z. Possible axis identifiers for the other axes are Y, A, B, C, U, V, W.

If G code system A is active (there is then no G91), incremental values are programmed for X, Z, Y with U, V, W. U, V, W can not then be used as axis identifiers, a maximum of 6 axes are possible. H is used to incrementally traverse the C axis.

If B is not used as an axis identifier, B can be used as an extended auxiliary function.
B is then output as auxiliary function H with address extension 1 (H1=).

Contour definition:

MD20734 $MC_EXTERN_FUNCTION_MASK, bit 0 is used to define the programming for the contour definition.

0: Contour definition is programmed with ,C ,R ,A (with commas). C and A can be axis identifiers.

1: Contour definition is programmed with C R A (without commas). C and A cannot be axis identifiers.

ISO dialect M axis names

The maximum number of axes is 8. The axis identifiers of the first 3 axes are fixed X, Y, Z. Possible axis names for the other axes are A, B, C, U, V, W.

If B is not an auxiliary function, B can be used as an axis identifier.

Axis interpolation

All programmable axes interpolate with one another as standard with ISO dialect.

This corresponds to FGROUP with ISO dialect M: X, Y, Z (A, B, C, U, V, W).
This corresponds to FGROUP with ISO dialect T: X, Z, Y (C).

MD22420 $MC_FGROUP_DEFAULT_AXES[0] is used to achieve this behavior if the machine has 4 axes:

$MC_FGROUP_DEFAULT_AXES[0] = 1
$MC_FGROUP_DEFAULT_AXES[1] = 2
$MC_FGROUP_DEFAULT_AXES[2] = 3
$MC_FGROUP_DEFAULT_AXES[3] = 4

Work offset (ISO dialect M only)

If only NVs G54 to G59 are used, MD28080 $MC_MM_NUM_USER_FRAMES or with global frames MD18601 $MC_MM_NUM_GLOBAL_USER_FRAMES >= 7 must be set.

If G54 is to be active after a reset, the following MD must be set to 1:

MD20154 $MC_EXTERN_GCODE_RESET_VALUES[13]
MD20150 $MC_GCODE_RESET_VALUES[7]

If the extended work offsets G54 P1 to P48 are used, MD28080 $MC_MM_NUM_USER_FRAMES or with global frames MD18601 $MC_MM_NUM_GLOBAL_USER_FRAMES >= 55 must be set.

If the following MD is set to 7, after a reset, G54 P1 is active:
MD20154 $MC_EXTERN_GCODE_RESET_VALUES[13]
MD20150 $MC_GCODE_RESET_VALUES[7]

G54 P1 is mapped to Siemens G507.

If an activated work offset is not to be retracted with G91, the following setting datum should be set to 0:
SD 42440 $SC_FRAME_OFFSET_INCR_PROG

Suppress tool lengths and radius compensation with G53:
MD10760 $MN_G53_TOOLCORR = 1

Metric/Inch switchover

The handwheel evaluation and increment evaluation are not switched over with G20 and G21. This switchover must be performed from the PLC: See MD31090 $MA_JOG_INCR_WEIGHT.

In ISO dialect mode, the work offsets are converted during the switchover. With ISO dialect original, the comma is simply moved.

Programming diameter or radius

When MD20150 $MC_GCODE_RESET_VALUES[28] = 2, diameter programming is activated for the transverse axis.

Decimal point programming

MD10884 $MN_EXTERN_FLOATINGPOINT_PROG is used to chose between Standard Notation and PocketcalculatorNotation.

Input resolution IS-B and IS-C is selected with MD10886 $MN_EXTERN_INCREMENT_SYSTEM.

Note that MD10200 $MN_INT_INCR_PER_MM and 10210 $MN_INT_INCR_PER_DEG are at least set such that input resolution IS-B or IS-C can be allocated.

If this is not the case, the programmed values are rounded.

Example: IS-C mm $MN_INT_INCR_PER_MM = 10000.

Scaling

MD22910 $MC_WEIGHTING_FACTOR_FOR_SCALE=0: 0.001

MD22910 $MC_WEIGHTING_FACTOR_FOR_SCALE=1: 0.00001

Axial scaling factor: MD43120 $MA_DEFAULT_SCALE_FACTOR_AXIS

Scaling factor P: MD42140 $MC_DEFAULT_SCALE_FACTOR_P

Enable axial scaling: MD22914 $MC_AXES_SCALE_ENABLE = 1 (when = 0, axial scaling is not possible)

Position in machine coordinate system G53

The axial speed for positioning with G53 and with G00 without interpolation is defined in MD32060 $MA_POS_AX_VELO.

With G53 X.. Y..., a position in the machine coordinate system is approached. The axes don't interpolate with one another, instead each axis moves to the programmed position separately at maximum speed.

Incremental positions are skipped in the G53 block. While tool radius compensation or tool length compensation is active (G41/G42, G43/G44), the axes are **not** traversed independently of one another, the axes are interpolated with one another.

Setting actual value G92

Delete the G92 movement at PowerOn:
MD24004 $MC_CHBFRAME_POWERON_MASK=1

G92 is retained during a reset (M30, channel reset):
MD20110 $MC_RESET_MODE_MASK bit 0 and bit 14=1

Resetting the tool coordinate system G92.1

With G92.1 X.. (G code system A: G50.3 P0), a moved coordinate system can be reset before being moved. The tool coordinate system is reset to the coordinate system that is defined by the active adjustable work offsets (G54-G59). The tool coordinate system is set to the reference position if no adjustable work offset is active. G92.1 resets shifts carried out through G92 or G52. However, only the axes that are programmed, are reset.

Example 1:

```
N10 G0 X100 Y100      ;Display: WCS: X100 Y100  MCS: X100 Y100
N20 G92 X10 Y10       ;Display: WCS: X10 Y10    MCS: X100 Y100
N30 G0 X50 Y50        ;Display: WCS: X50 Y50    MCS: X140 Y140
N40 G92.1 X0 Y0       ;Display: WCS: X140 Y140  MCS: X140 Y140
```

Example 2:

```
N10 G10 L2 P1 X10 Y10
N20 G0 X100 Y100      ;Display: WCS: X100 Y100  MCS: X100 Y100
N30 G54 X100 Y100     ;Display: WCS: X100 Y100  MCS: X110 Y110
N40 G92 X50 Y50       ;Display: WCS: X50 Y50    MCS: X110 Y110
N50 G0 X100 Y100      ;Display: WCS: X100 Y100  MCS: X160 Y160
N60 G92.1 X0 Y0       ;Display: WCS: X150 Y150  MCS: X160 Y160
```

Delete distance-to-go

With ISO dialect original, G31 can be used to delete the distance-to-go. The distance-to-go is only deleted in this block if the PLC signal is in place for the channel. Without G31, the signal is not evaluated.

In ISO dialect mode, the PLC signals are evaluated in each block regardless of G31. G31 is used to activate probe 1.

With ISO dialect, the deleted distance-to-go can be calculated using PLC Varselector.

The function G31 P1 (.. P4) is different from G31 in that different inputs for the measuring signal can be selected with P1-P4. Several inputs can also be monitored on a rising edge of a measuring signal simultaneously. The assignment of the inputs to the addresses P1 to P4 is defined by the following machine datum.

MD10810 $MN_EXTERN_MEAS_G31_P_SIGNAL[0 .. 3].

Note

Only two measuring inputs are available for 840D.

Spindle position

The spindle position for M19 is set using setting datum 43240 $SC_M19_SPOS.

Protection zone

If G commands G22 and G23 are used, there must be a protection zone:

MD18190 $MM_NUM_PROTECT_AREA_NCK = 1
MD28210 $MC_NUM_PROTECT_AREA_ACTIVE = 1

Auxiliary function output

If value H is to be output to the PLC as an integer value, MD22110 $MC_AUXFU_H_TYPE_INT must be set to 1.

The time at which the auxiliary function is output (M, S, T, H) to the PLC can be set using machine data:

0 = Auxiliary function output before motion

1 = Auxiliary function output during motion

2 = Auxiliary function output after motion

3 = Motion is not output to PLC

MD22200 $MC_AUXFU_M_SYNC_TYPE for M functions
MD22210 $MC_AUXFU_S_SYNC_TYPE for S functions
MD22220 $MC_AUXFU_T_SYNC_TYPE for T functions
MD22230 $MC_AUXFU_H_SYNC_TYPE for H functions

Approaching 1st home position G28

The following machine data must be set:

- 20050 $MC_AXCONF_GEOAX_ASSIGN_TAB[0-2]

  Axis 1 to 3
- 20060 $MC_AXCONF_GEOAX_NAME_TAB[0-2]

  Axis names for milling: X, Y, Z
  Axis names for turning: X, Z, Y
- 200070 $MC_AXCONF_MACHAX_USED[0-3]

  Axis 1 to 4
- 20080 $MC_AXCONF_CHANAX_NAME_TAB[0-3]

  4th axis name for milling: X, Y, Z are permanently assigned; A, B, C, U, V or W can also be selected.
  4th axis name for turning: X, Z, Y are permanently assigned; C can also be selected
- 20100 $MC_DIAMETER_AX_DEF

  Only when turning: X axis
- 20150 $MC_GCODE_RESET_VALUES[28]

  Radius or diameter programming

  1 = DIAMOF (radius for G90/G91)

  2 = DIAMON (diameter for G90/G91)

  3 = DIAM90 (diameter for G90, radius for G91)

  Note: DIAM90 is treated like DIAMON within the cycle.
- 34100 $MA_REFP_SET_POS[0]

  0 = 1st home position

  Enter value for each axis
- 35000 $MA_SPIND_ASSIGN_TO_MACHAX

  0 = Axis is not spindle

  1 = Axis is a spindle

Approaching 2nd, 3rd, 4th reference point G30

The following machine data must be set:

- 20050 $MC_AXCONF_GEOAX_ASSIGN_TAB[0-2]

  Axis 1 to 3
- 20060 $MC_AXCONF_GEOAX_NAME_TAB[0-2]

  Axis names for milling: X, Y, Z

  Axis names for turning: X, Z, Y
- 20070 $MC_AXCONF_MACHAX_USED[0-3]

  Axis 1 to 4
- 20080 $MC_AXCONF_CHANAX_NAME_TAB[0-3]

  4th axis name for milling: X, Y, Z are permanently assigned; A, B, C, U, V or W can also be selected.

  4th axis name for turning: X, Z, Y are permanently assigned; C can also be selected
- 20100 $MC_DIAMETER_AX_DEF

  Only when turning: X axis
- 20150 $MC_GCODE_RESET_VALUES[28]

  Radius or diameter programming

  1 = DIAMOF (radius for G90/G91)

  2 = DIAMON (diameter for G90/G91)

  3 = DIAM90 (diameter for G90, radius for G91)

  Note: DIAM90 is treated like DIAMON within the cycle.
- 34100 $MA_REFP_SET_POS[1,2,3]

  1,2,3 = 2nd, 3rd, 4th home position

  Enter value for each axis
- 35000 $MA_SPIND_ASSIGN_TO_MACHAX

  0 = Axis is not spindle

  1 = Axis is a spindle

G30.1 home position

The home position process is realized in the CYCLE328 cycle. The home position is written in setting datum 43340 $SC_EXTERN_REF_POSITION_G30_1.

5.1.1 Active G command for PLC

The user can use MD22512 $MC_EXTERN_GCODE_GROUPS_TO_PLC to select the G groups of an external language whose active G command is to be reported to the PLC.

$MC_EXTERN_GCODE_GROUPS_TO_PLC[0..7]=0

5.1.2 Tool change, tool data

No cutting edge is selected during a tool change.

MD20270 $MC_CUTTING_EDGE_DEFAULT = 0

Setting datum: During a tool change, with G91 the compensation is not retracted

SD42442 $SC_TOOL_OFFSET_INCR_PROG = 0

The assignment of tool length compensation to geometry axes is fixed:

Length 1: Z
Length 2: Y
Length 3: X

SD42940 $SC_TOOL_LENGTH_CONST =17

Effectiveness of tool length compensation beyond reset:

MD20110 $MC_RESET_MODE_MASK = 'B1000000'

Effectiveness of tool compensation with programming of T/H/D, not with M6

MD22550 $MC_TOOL_CHANGE_MODE = 0

5.1.3 G00 always with exact stop

At high speeds, collisions may occur during active continuous-path mode in G00 mode when smoothing. MD20734 $MC_EXTERN_FUNCTION_MASK, bit 4 is used to determine the exact stop behavior with G00.

MD20734 $MC_EXTERN_FUNCTION_MASK, bit 4=0, G00 is traversed with the exact stop function currently active. If G64 is active, the G00 blocks are also traversed with G64.

MD20734 $MC_EXTERN_FUNCTION_MASK, bit 4=1, each G00 block with traversing is traversed with G09 (non-modal exact stop). Even if G64 is active, the non-modal exact stop takes effect in every G00 block.

5.1.4 Response to syntax faults

Response to faults occurring

MD20734 $MC_EXTERN_FUNCTION_MASK, bit 3 is used to determine the response to faults occurring in the first part of the ISO Translator. Here the entire ASCII block is examined.

If bit 3==0, an NC alarm is output and processing is stopped if unknown addresses are found.

If bit 3==1, no alarm is output, the ASCII block is forwarded to the Siemens Translator. The NC block following this is first given back to the ISO Translator and an attempt is made in the Siemens Translator to translate the ASCII block.

This allows unique Siemens blocks to be programmed without using G290 to switch to Siemens mode while ISO mode is active.

The current ISO G code is displayed in the G code window, a switch is not made to Siemens mode.

If a G function, which can be translated directly to an ISO G code, is activated in such a block in the Siemens Translator, the G codes are updated here.

Example

20734 $MC_EXTERN_FUNCTION_MASK, bit 3==0

```
N5 G291                          ;ISO mode
N10 WAIT                         ;Alarm 12080 "WAIT unknown"
N15 G91 G500                     ;Alarm 12080 "G500 unknown"
```

20734 $MC_EXTERN_FUNCTION_MASK, bit 3==1

```
N5 G291                          ;ISO mode
N10 WAIT                         ;block is processed by the Siemens Translator
N15 G91 G500                     ;block is processed by the Siemens Translator
N20 X Y                          ;because of G291, block is processed by
                                 ;ISO Translator,
                                 ;G91 from N15 is active
```

Note

Unwanted responses may result from incorrect programming in ISO mode.

Example for ISO M:

To be programmed: G90 G76 ;modal cycle call

but the following is entered: G90 G75

G75 is not available in ISO M mode, the block goes to the Siemens Translator and results in "Move to fixed point" without any query or alarm G75.

5.1.5 Selection of code system A, B, C (ISO dialect T)

Function

In ISO dialect-T, a differentiation is made between G code system A, B and C. By default, the G code system B is active.

Code system A, B or C is selected in MD10881 $MN_MM_EXTERN_GCODE_SYSTEM. The "Rename G codes" function is not used by this function, the user can use this function without any limitations.

As previously, switching over with a cycle is still possible.

$MN_MM_EXTERN_CNC_SYSTEM = 1: ISO dialect M
$MN_MM_EXTERN_CNC_SYSTEM = 2: ISO dialect T

$MN_MM_EXTERN_GCODE_SYSTEM = 0: G code system B

$MN_MM_EXTERN_GCODE_SYSTEM = 1: G code system A

$MN_MM_EXTERN_GCODE_SYSTEM = 2: G code system C

In order for the shell cycle to work in the correct G code system, the corresponding system must be entered in the GUD variable _ZSFI[39]:

_ZSFI[39]: Setting datum for G code system with ISO T

0 = G code system B
1 = G code system A
2 = G code system B
3 = G code system C

Inch/metric changeover

With ISO dialect original there is a MD which is used to determine how the inch/metric changeover is programmed, either with G20/21 or G70/71. This MD does not exist for ISO dialect mode, it can also not be selected using $MN_MM_EXTERN_GCODE_SYSTEM.

G20/G21 is active by default. A switchover to G70/71 is realized using MD10712 $MN_USER_CODE_CONF_NAME_TAB.
$MN_USER_CODE_CONF_NAME_TAB[0]= G20
$MN_USER_CODE_CONF_NAME_TAB[1]= G70
$MN_USER_CODE_CONF_NAME_TAB[2]= G21
$MN_USER_CODE_CONF_NAME_TAB[3]= G71

Regardless of G20/21 G70/71, a 1 is read in system variable $P_GG[6] with G20/G70 and a 2 with G21/G71.

5.1.6 Fixed feedrates F0 - F9

Function

Ten different feedrate values pre-set via setting data can be activated with F0-F9.

To activate the rapid traverse rate with F0, the corresponding speed must be entered in the setting datum 42160 $SC_EXTERN_FIXED_FEEDRATE_F1_9[0].

The feedrate values for F0-F9 are entered in the setting data as real values. An evaluation of the input values is not undertaken.

The function is activated via MD22920 $MC_EXTERN_FIXED_FEEDRATE_F1_ON. If the machine data is set to FALSE, F1-F9 is interpreted as normal feedrate programming, e.g. F2=2 mm/min, F0=0 mm/min.

If the machine data = TRUE, the feedrate values for F0-F9 are fetched from the setting data 42160 $SC_EXTERN_FIXED_FEEDRATE_F1_F9[ ]. If the value 0 exists in one of the setting data, then the corresponding address extension of feedrate 0 is activated during the programming.

Example

$SC_FIXED_FEEDRATE_F1_F9[0] = 5000
$SC_FIXED_FEEDRATE_F1_F9[1] = 1000
$SC_FIXED_FEEDRATE_F1_F9[2] = 500

```
N10 X10 Y10 Z10 F0 G94                    ;Approach position at 5000 mm/min
N20 G01 X150 Y30 F1                       ;Feedrate 1000 mm/min active
N30 Z0 F2                                 ;Position approached at 500 mm/min
N40 Z10 F0                                ;Approach position at 5000 mm/min
```

If the function is activated with MD22920 $MC_FIXED_FEEDRATE_F1_F9_ON and if the feedrate value from the setting datum is not to be active with F1-F9, then the feedrate value is programmed as a real value. If, for instance, a feedrate value should be programmed at 1 mm/min, the feedrate must be programmed with F1.0 instead of F1.

Note

While macroprogramming with G65/66, the programmed value for the address F is always entered in the $C_F system variable. The address signifies a transfer variable here and has no direct reference to the feedrate.

The same is true of the thread lead programming in G33-G34 with address F. No feedrate is programmed with F here, instead the distance between 2 threads during a spindle revolution.

In cycle programming (e.g., G81 X.. Y.. Z.. R.. P.. Q.. F..), the feedrate is always programmed under address F. In a part program block with a cycle call via a G function (G81-G87 etc.), the corresponding feedrate value during the programming of F1-F9 is written from the corresponding setting datum in the variable $C_F.

Restriction

In ISO dialect mode, the feedrate values are changed in the setting data with a handwheel. In Siemens mode, the feedrates can be influenced only like a directly programmed feedrate, e.g. using the override switch.

5.1.7 Parallel axes G17 (G18/G19)<Axis name>..

Function G17 (G18, G19)<Axis name>.. can be used to activate an axis parallel to the basic axis in the coordinate system.

The basic axes are e.g. X, Y and Z. The following programming is used to activate axis U in the G17 plane in place of basic axis X:

```
G17 U0 Y0  ;activation of parallel axis U
```

This function can be reproduced with the 840D function GEOAX (..,..). GEOAX() can be used to replace a geometry axis with any channel axis. But all frames (apart from handwheel and external movement), the working area limitation and the protection zones are then deleted. The user can prevent the frames from being deleted with MD10602 $MN_FRAME_GEOAX_CHANGE_MODE, the protection zones from being deleted with MD10618 $MC_PROTAREA_GEOAX_CHANGE_MODE and working area limitation from being deactivated with MD10604 $MN_WALIM_GEOAX_CHANGE_MODE.

One parallel axis can be defined for each of the 3 geometry axes using MD22930 $MC_EXTERN_PARALLEL_GEOAX[ ]. By programming the G function for plane selection (G17-G19) and the axis name of the parallel axis, a geometry axis interchange is then carried out as with the GEOAX(), function.

During the selection of planes (geometry axis interchange with parallel axis), the axes are moved to their programmed position.

If a basic axis of the coordinate system is programmed along with its parallel axis in a plane selection block, alarm 12726 "Impermissible plane selection with parallel axes" is output.

5.1.8 Inserting chamfers and radii

Chamfers and radii

The process of inserting chamfers and radii is mapped to the corresponding Siemens functionality. The two blocks between which a radius or chamfer is to be inserted must always be programmed. If there are several addresses programmed in a block, the last radius programmed always takes effect.

In ISO dialect M mode, the name for the radius is always "R" and for the chamfer "C". As soon as a comma is programmed in the block, addresses R and C to the right after the comma are interpreted as radius and chamfer. If a circle is to be programmed with radius R or axis C, the two addresses must be positioned to the left before the comma. A radius or chamfer can be inserted between linear blocks, circle blocks or a mix of the two.

In ISO dialect T mode, the name for the radius is always "R", while addresses "C", "I" and "K" can be used for the chamfer. Address C may only be used if it is not defined as an axis name. Radii and chamfers can only be inserted between linear blocks. The linear blocks do not have to be above one another vertically. Programming a sign before the chamfer and/or radius is of no significance here because the direction of the chamfer and/or radius is defined with the 2nd straight line block.

ISO dialect M programming

Chamfers and radii are always marked in the block with a comma. The address for a chamfer is "C" and for a radius is "R". Chamfers and radii can be inserted between linear blocks and circle blocks.

```
N10 X100. ,R10              ;insert radius of 10 mm
N20 Y30. ,C5                ;insert chamfer of 5 mm
N30 X150. Y40.
N40 G03 X180. Y65. R30, R8
N50 G01 X150. ,R8
```

ISO dialect T programming

Chamfers and radii are not marked in the block with a comma. The address for a radius is always "R", address "I", "K" or "C" can be used for a chamfer. C may only be used if the address is not defined as an axis name.

In ISO dialect T mode, chamfers and radii can only be inserted between 2 linear blocks.

```
N10 X100. R10               ;insert radius of 10 mm
N20 Z30. C5                 ;insert chamfer of 5 mm
N30 X150. Z40.
N40 X180. Z65. I8
N50 G01 X150. K8
```

5.1.9 Rotary axis function

If an axis is defined as a rotary axis, this axis can be traversed as follows:

- Axis is traversed as linear axis

  No modulo conversion is active.

  Positive and negative values can be programmed

  MD30300 $MA_IS_ROT_AX = TRUE

  MD30310 $MA_ROT_IS_MODULO = FALSE

- Example:

```
N5 G90 B0
N10 B370                                ;axis moves to 370 degrees
N15 B-10                                ;axis moves to -10 degrees
N20 G91 B-20                            ;axis moves to -20 degrees
```

- Axis traverses at shortest distance

  Modulo conversion is active

  Values < 0 and > modulo value can be programmed

  MD30300 $MA_IS_ROT_AX = TRUE

  MD30310 $MA_ROT_IS_MODULO = TRUE

  MD20734 $MC_EXTERN_FUNCTION_MASK, bit 5 = 0

  MD30455 $MA_MISC_FUNCTION_MASK, bit 0 = 1

  Example:

```
N5 B0                                ;axis moves to 0 degrees
N10 B10                              ;axis moves to 10 degrees, positive
                                     ;direction of rotation
N15 B350                             ;axis moves to 350 degrees, negative
                                     ;direction of rotation
N20 B-5                              ;axis moves to 355 degrees, positive
                                     ;direction of rotation
N25 G91 B-10                         ;axis moves to 345 degrees, negative
                                     ;direction of rotation
```

- Axis traverses in positive or negative direction depending on sign programmed

  Modulo conversion is active

  Values < 0 and > modulo value can be programmed

  MD30300 $MA_IS_ROT_AX = TRUE

  MD30310 $MA_ROT_IS_MODULO = TRUE

  MD20734 $MC_EXTERN_FUNCTION_MASK, bit 5 = 1

  MD30455 $MA_MISC_FUNCTION_MASK, bit 0 = 1

  Example:

```
N5 B0                                ;axis moves to 0 degrees
N10 B10                              ;axis moves to 10 degrees,
                                     ;positive direction of rotation
N15 B350                             ;axis moves to 350 degrees,
                                     ;positive direction of rotation
N20 B-5                              ;axis moves to 355 degrees,
                                     ;negative direction of rotation
N25 G91 B-10                         ;axis moves to 345 degrees,
                                     ;negative direction of rotation
```

In this case, the sign has two meanings, it is taken into account in the modulo conversion and determines the direction of rotation.

The response is the same for all types of interpolation.

Incremental motion is always executed depending on the sign.

5.1.10 Program coordination between 2 channels and M commands

Overview

M functions which serve as WAIT marks can be programmed to synchronize the program sequence between two channels. If one such M function is reached in the part program of one channel, the program sequence is stopped until the other channel has also reached the same M function. The part programs in the two channels are then processed further.

The M function numbers for the Wait marks are defined with two pieces of machine data. A range of M numbers is defined and reserved for this function.

Machine datum 10800 $MN_EXTERN_CHAN_SYNC_M_NO_MIN marks the smallest M number and 10802 $MN_EXTERN_CHAN_SYNC_M_NO_MAX the largest M number in the range reserved for program coordination. Machine datum $MN_EXTERN_CHAN_SYNC_M_NO_MAX must not exceed ($MN_EXTERN_CHAN_SYNC_M_NO_MIN + 10 * number of channels).

To avoid conflicts with standard M functions, the smallest M number (MD $MN_EXTERN_CHAN_SYNC_M_NO_MIN) must not be less than 100. If the machine data is predefined with -1, this means that program coordination in ISO dialect T/M mode is not possible.

If a value <100 is entered in $MN_EXTERN_CHAN_SYNC_M_NO_MIN or a value <$MN_ETERN_CHAN_SYNC_M_NO_MIN is entered in $MN_EXTERN_CHAN_SYNC_M_NO_MAX, alarm 4170 "Impermissible number for channel synchronization" is output.

The function is mapped to the WAITM command of the Siemens language (WAITM(<mark>, <channel number>, <channel number>)). Channel synchronization in ISO dialect T/M mode is always carried out for channels 1 and 2. All other channels can only be synchronized in Siemens mode.

The M numbers are not output to the PLC.

The M functions for channel synchronization must be the only things in their block.
The system issues alarm 12080 "Channel %1 block %2 syntax error for text" if addresses other than "M" are programmed in the block.

For a more detailed description, see

/PGA/ SINUMERIK 840D/810D/FM-NC Programming Manual Job Planning, "Program coordination" chapter

Constraint

Only 10 M functions (WAIT marks) can be set per channel. The difference between $MN_EXTERN_CHAN_SYNC_M_NO_MAX and $MN_EXTERN_CHAN_SYNC_M_NO_MIN must therefore not exceed 20 in a 2-channel system. With ISO dialect original 99999899 M numbers can be defined as wait marks.

5.2 Standard machine data assignment for ISO dialect

ISO dialect M

Standard assignment of MD20154 $MC_EXTERN_GCODE_RESET_VALUES[ ]:

$MC_EXTERN_GCODE_RESET_VALUES[0] = 1	G00
$MC_EXTERN_GCODE_RESET_VALUES[1]=1	G17
$MC_EXTERN_GCODE_RESET_VALUES[2]=1	G90
$MC_EXTERN_GCODE_RESET_VALUES[3]=2	G23
$MC_EXTERN_GCODE_RESET_VALUES[4]=1	G94
$MC_EXTERN_GCODE_RESET_VALUES[5]=1	G20
$MC_EXTERN_GCODE_RESET_VALUES[6]=1	G40
$MC_EXTERN_GCODE_RESET_VALUES[7]=3	G49
$MC_EXTERN_GCODE_RESET_VALUES[8]=4	G80
$MC_EXTERN_GCODE_RESET_VALUES[9]=1	G98
$MC_EXTERN_GCODE_RESET_VALUES[10]=1	G50
$MC_EXTERN_GCODE_RESET_VALUES[11]=2	G67
$MC_EXTERN_GCODE_RESET_VALUES[12]=2	G97
$MC_EXTERN_GCODE_RESET_VALUES[13]=1	G54
$MC_EXTERN_GCODE_RESET_VALUES[14]=3	G64
$MC_EXTERN_GCODE_RESET_VALUES[15]=2	G69
$MC_EXTERN_GCODE_RESET_VALUES[16]=1	G15
$MC_EXTERN_GCODE_RESET_VALUES[17]=0	non-modal
$MC_EXTERN_GCODE_RESET_VALUES[21]=1	G50.1
$MC_EXTERN_GCODE_RESET_VALUES[24]=1	G12.1
$MC_EXTERN_GCODE_RESET_VALUES[30]=1	G290

ISO dialect T

Standard assignment of MD20154 $MC_EXTERN_GCODE_RESET_VALUES[ ]:

Several G code systems are available as options for ISO dialect T. The same function is called using different G commands. G code system B is realized as standard. Machine datum 10881 $MN_ EXTERN_GCODE_SYSTEM is used to use another G code system.

$MC_EXTERN_GCODE_RESET_VALUES[0]=1	G00
$MC_EXTERN_GCODE_RESET_VALUES[1]=2	G97
$MC_EXTERN_GCODE_RESET_VALUES[2]=1	G90
$MC_EXTERN_GCODE_RESET_VALUES[3]=2	G69
$MC_EXTERN_GCODE_RESET_VALUES[4]=2	G95
$MC_EXTERN_GCODE_RESET_VALUES[5]=1	G21
$MC_EXTERN_GCODE_RESET_VALUES[6]=1	G40

$MC_EXTERN_GCODE_RESET_VALUES[8]=2	G23
$MC_EXTERN_GCODE_RESET_VALUES[9]=1	G80
$MC_EXTERN_GCODE_RESET_VALUES[10]=1	G98
$MC_EXTERN_GCODE_RESET_VALUES[11]=2	G67
$MC_EXTERN_GCODE_RESET_VALUES[15]=2	G18
$MC_EXTERN_GCODE_RESET_VALUES[17]=0	non-modal
$MC_EXTERN_GCODE_RESET_VALUES[19]=1	G50.2
$MC_EXTERN_GCODE_RESET_VALUES[20]=1	G12.1
$MC_EXTERN_GCODE_RESET_VALUES[30]=1	G290

Supplementary conditions

6

6.1 Supplementary conditions

Availability of the "ISO dialect" function

The function is an option for SINUMERIK 840D, 840Di and 810D powerline.

The function is standard for SINUMERIK 802D sl, 840D sl and 840Di sl.

6.2 Constraints

The functions with which **non-compatible** behavior towards ISO dialect original occurs in SINUMERIK 840D's ISO dialect mode are listed below.

Mode switchover

The standard machine data block only realizes "Siemens" mode. No external NC language is generated as the 2nd G code table.

Machine datum $MN_NC_USER_CODE_CONF_NAME_TAB is only valid for NC language commands in Siemens mode.

For reasons associated with compatibility with Siemens mode (relating to machine data input, BTSS interface"data field"[0] = 1st G group), in ISO dialect mode, the G groups 0 defined in the ISO dialect original system are implemented:

ISO dialect M: G group 0 → G group 18

ISO dialect T: G group 0 → G group 17

Implied mode change

Asubs, INI files and macro/GUD definition files are always processed in Siemens mode.
If necessary, an implicit mode change to Siemens mode is undertaken here. At the end of processing, a switch is made back to the external CNC system's original mode.

6.2.1 Program commands

F value

ISO dialect M has fixed F values which are selected using F1 to F9. These fixed values are not available in ISO dialect mode. F1 to F9 is interpreted as values F1 to F9.

G02/G03

G02/G03 programming without radius details in ISO dialect T original results in G01, in ISO dialect M original it results in a complete circle with an undefined radius. In ISO dialect mode, an NC alarm is output in both cases.

G04 X..

With ISO dialect original, the dwell time is displayed in the X axis as distance-to-go.
This dwell time is not displayed in ISO dialect mode, the "Dwell time running" message appears.

G16

Polar coordinate programming is ended with G15.

With ISO dialect original, the pole radius and pole angle are retained. When G16 is next programmed, incremental additions can be made to the angle. Non-reproducible traversing is undertaken. The angle and radius are deleted using a reset or M30.

In ISO dialect mode, G15 is used to delete the pole radius and pole angle. G16 always results in an angle and radius of 0 being traversed.

Example: Axis U is parallel to axis X

G17 U Y ; plane U Y is selected rather than plane X Y.

In ISO dialect mode, a parallel axis **cannot** be programmed with G17/G18/G19.

G20/G21

In ISO dialect original mode, the work offsets are not converted during the switchover.
The comma is simply moved by one decade. The work offset values are converted in full in ISO dialect mode.

G22

In ISO dialect M original, G22 is used to activate protection zone 4. This does not exist in step 1. Protection zones 1/2 and 3 are realized. Protection zone 4 is permanently entered in ISO dialect using machine data. This is not possible with 840D. There is only one protection zone in ISO dialect mode.

G40

In ISO dialect T mode, a vector which influences the response at the block end can be programmed in the linear block with I, J, K. This function is not available in ISO dialect original mode. If I, J and K is programmed for G40, an NC alarm is output.

G41/G42

The milling radius compensation functions are not compatible between ISO dialect original and 840D.

G53

If G53 (approach position in machine coordinate system) is called while G41/G42 is active, the axes are not traversed separately but in an interpolating manner.

G63

With ISO dialect, G63 can be written in every block. The override is locked in this block. Override 0 also results in a stop at the start of a G53 block. This function is helpful when used in conjunction with tapping without floating tapholder in a G01 interpolation. In ISO dialect mode, G63 is only effective in a G01 block. If G63 is selected in a G00 block, this has no impact on this block.

G94/G95

If a change is made from revolutional feedrate (G95) to linear feedrate (G94) or vice versa, feedrate F has to be reprogrammed each time. If there is no feedrate, this results in alarm 10860 "No feedrate programmed". When changing the type of feedrate, ISO dialect original mode interprets the feedrate programmed either as revolutional or linear feedrate.

M06

Tool change cycle: If MD10715 $MN_M_NO_FCT_CYCLE and 10716 $MN_M_NO_FCT_CYCLE_NAME are used to assign a cycle to an M function, not all the parameters programmed in the block can be accessed in the cycle. Only the programmed tool number can be read with $C_T/$C_T_PROG. Traversing in the M block is retracted before the call.

G functions that define the syntax

With ISO dialect original several G commands that define syntax can be programmed in a block. A distinction is made as to:

- Defining syntax → non-modal
- Defining syntax → modal
- Non-syntax → modal
- Non-syntax → non-modal

In Siemens mode, more than one G function that defines syntax in a block will result in an alarm.

6.2.2 Tool management

Tool management and service life and quantity monitoring can be reproduced with the Siemens tool management function.

Tool data

Milling: Only tool compensation memory C is supported, i.e. the tool compensation memory is spread over several columns (D == H applies).

The version where the tool and compensation number for milling are produced from the same value is not supported.

The current tool data cannot be read out/archived in ISO dialect mode (G10). The tool data can only be changed via G10 if the tool compensation has been set up via operator input.

Tool length compensation

If the tool length compensation input in the diameter is active, the input for geometry and wear in the diameter can be parameterized with ISO dialect original. Only wear in the diameter is stated in ISO dialect mode. The geometry is always stated in the radius.

With ISO dialect original, the tool length is calculated as diameter or radius in the transverse axis depending on a machine parameter.

In Siemens mode the tool length compensation is always calculated as diameter; a switchover is not possible.

The tool length compensation cannot be undertaken by moving the coordinate system.

Geometry and wear cannot be taken from different compensation memories for turning technology.

Modified tool compensations take effect when the next T, H or D value is programmed.

6.2.3 Control response with power on, reset and block search

Power on

During power on, the Siemens G code list containing possible recoding from MD10712 $MN_NC_USER_CODE_CONF_NAME_TAB is created for all NC channels.

Power up, reset

The power up and reset response is defined using MD20150 $MC_GCODE_RESET_VALUES[46] and depending on MD10880 $MN_MM_EXTERN_CNC_SYSTEM.

This decides between the G codes of ISO dialect M and ISO dialect T.

Switching between Siemens and ISO dialect mode in the program sequence has no impact on the modal G functions.

Block search

The "Search for block end point" block search type available in Siemens mode corresponds to the block search response in ISO dialect.

When in the "Block search without calculations" operating mode, the user must ensure a sensible search destination, especially for NC programs with a mode switchover (e.g. NC block with command from G group 47).

Data descriptions (MD, SD)

7

7.1 General machine data

Note

All the machine data described here relates to the SINMERIK 84D sl. Please use the associated List Manuals for the SINUMERIK 802D sl and SINUMERIK 828D controls.

10604	WALIM_GEOAX_CHANGE_MODE		
SD number	Working area limitation during switchover of geometry axes		
Default setting: 0	Min. input limit: 0	Max. input limit: 1	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	The machine datum is used to define whether a possibly active working field limitation is retained or deactivated during a geometry axis interchange. The machine data values have the following meanings: Bit 0=0: Working field limitation is deactivated during geometry axis interchange Bit 0=1: Active working area limitation remains active during geometry axis interchange		

10615	NCBFRAME_POWERON_MASK		
MD number	Reset global basic frames after power on		
Default setting: 0	Min. input limit: 0	Max. input limit: 0	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	This machine datum is used to define whether global basic frames are reset in the data management during power on. That is - movements are set to 0, - scaling is set to 1. Mirroring is switched off. The individual basic frames can be selected separately. Bit 0 corresponds to basic frame 0, bit 1 to basic frame 1 etc. 0: Basic frame is retained during power on 1: Basic frame is deleted during power on		
Corresponds to:	MD24004 CHBFRAME_POWERON_MASK		

10652	CONTOUR_DEF_ANGLE_NAME		
MD number	Name of angle for contour definitions		
Default setting: "ANG"	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 0/0	Unit: -	
Data type: STRING	Applies as of SW:		
Meaning:	Identifier for contour angle. The identifier must be selected ensuring that there is no conflict with other identifiers (e.g. axes, Euler angle, normal vector, direction vector, coordinate of intermediate point).		

10654	RADIUS_NAME		
MD number	Name of radius for contour definitions		
Default setting: "RND"	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 0/0	Unit: -	
Data type: STRING	Applies as of SW:		
Meaning:	Identifier for contour definition radius. The identifier must be selected ensuring that there is no conflict with other identifiers (e.g. axes, Euler angle, normal vector, direction vector, coordinate of intermediate point).		

10656	CHAMFER_NAME		
MD number	Name of chamfer for contour definitions		
Default setting: "CHR"	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 0/0	Unit: -	
Data type: STRING	Applies as of SW:		
Meaning:	Identifier for contour definition chamfer The identifier must be selected ensuring that there is no conflict with other identifiers (e.g. axes, Euler angle, normal vector, direction vector, coordinate of intermediate point).		

10704	DRYRUN_MASK		
MD number	Activation of dry run feedrate		
Default setting: 0	Min. input limit: 0	Max. input limit: 2	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	DRYRUN_MASK == 0 DRYRUN should be switched on and off only at end of block. If DRYRUN_MASK = 1, the dry run feedrate can also be activated during execution of the program (in the part program block). **Note:** The axes are stopped for the duration of the reorganization operation after the dry run feedrate is activated. DRYRUN_MASK = 2 DRYRUN can be switched on and off in each phase, and the axes are not stopped. **Note:** However the function only becomes effective with a block which comes "later" in the program sequence and that happens with the next (implicit) StopRe block.		
Corresponds to:	SD42100 DRY_RUN_FEED		

10706	SLASH_MASK		
MD number	Activation of block skip function		
Default setting: 0	Min. input limit: 0	Max. input limit: 2	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	When SLASH_MASK = 0, the block skip function can only be activated at the end of a block. When SLASH_MASK = 1, the activation of block skip function will also be possible during program processing. **Caution:** The axes are stopped for the duration of the reorganization operation after the block skip function is activated. When SLASH_MASK = 2, the block skip function can be activated in any phase. **Caution:** The function only becomes effective with a block which comes "later" in the program run! The function is effective from the next (implicit) stop reset block.		

Note

The number of field elements in machine data 10715 $MN_M_NO_FCT_CYCLE[ ], 10716 $MN_M_NO_FCT_CYCLE_NAME[ ], 10814 $MN_EXTERN_M_NO_MAC_CYCLE[ ], 10815 $MN_EXTERN_M_NO_MAC_CYCLE_NAME[ ] has been increased from 10 to 30. A subprogram call can therefore be assigned to 30 M functions.

10715	M_NO_FCT_CYCLE		
MD number	M function to be replaced by a subprogram		
Default setting: -1	Min. input limit: -1	Max. input limit: -	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	M number with which the subprogram is called. The name of the subprogram is stored in $MN_M_NO_FCT_CYCLE_NAME[ ]. If the M function defined using $MN_M_NO_FCT_CYCLE[ ] is programmed in a part program, then the subprogram defined in M_NO_FCT_CYCLE_NAME is started at the end of block. If the M function is reprogrammed in the subprogram, then there is no longer any replacement by a subprogram call. $MN_M_NO_FCT_CYCLE[ ] acts both in the Siemens mode G290 as well as in the external language mode G291. Constraints: The subprograms configured with $MN_M_NO_FCT_CYCLE_NAME[ ] and $MN_T_NO_FCT_CYCLE_NAME[ ] may not be effective in one block (part program line) at the same time, i.e. max. one M/T function replacement can be effective per block. Neither an M98 nor a modal subprogram call may be programmed in the block with the M function replacement. A subprogram return jump or end of part program is also not permitted. Alarm 14016 is generated if these conventions are not observed. A subprogram call must not be superimposed on M functions with predetermined significance. Alarm 4150 is generated in the event of a conflict: The following M functions are checked: • M0 to M5, • M17, M30, • M19, • M40 to M45, • M functions for "Macro call via M function" according to machine datum $MN_EXTERN_M_NO_MAC_CYCLE • M functions for interrupt programming according to configuration using $MN_EXTERN_M_NO_SET_INT and $MN_EXTERN_M_NO_DISABLE_INT • M functions for channel synchronization according to configuration using $MN_EXTERN_CHAN_SYNC_M_NO_MIN and $MN_EXTERN_CHAN_SYNC_M_NO_MAX • M functions for switching over spindle/axis mode according to machine datum $MC_SPIND_RIGID_TAPPING_M_NR (default M70) • for applied external language ($MN_MM_EXTERN_LANGUAGE) also M19, M96 to M99. Exception: The M functions defined by $MC_TOOL_CHANGE_M_CODE for the tool change.		
Corresponds to:	$MN_EXTERN_M_NO_MAC_CYCLE MN_EXTERN_M_NO_SET_INT MN_EXTERN_M_NO_DISABLE_INT MN_EXTERN_CHAN_SYNC_M_NO_MIN MN_EXTERN_CHAN_SYNC_M_NO_MAX MC_EXTERN_RIGID_TAPPING_M_NR		

10716	M_NO_FCT_CYCLE_NAME[0]		
MD number	Subprogram name for M function replacement		
Default setting: -	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: STRING	Applies as of SW:		
Meaning:	The cycle name is stored in the machine data. This cycle is called if the M function was programmed from machine datum $MN_M_NO_FCT_CYCLE. If the M function is programmed in a motion block, then the cycle is executed after the motion. $MN_M_NO_FCT_CYCLE acts both in the Siemens mode G290 as well as in the external language mode G291. If a T number is programmed in the call block, the programmed T number can be queried in the cycle under the variable $P_TOOL. M and T function replacement may not be effective in one block at the same time, i.e. max. one M/T function replacement can be effective per block. Neither an M98 nor a modal subprogram call may be programmed in the block with the M function replacement. A subprogram return jump or end of part program is also not permitted. Alarm 14016 is generated if these conventions are not observed.		
Corresponds to:	MD10715 $MN_M_NO_FCT_CYCLE MD10716 $MN_T_NO_FCT_CYCLE_NAME		

10717	T_NO_FCT_CYCLE_NAME		
MD number	Name of tool change cycle for T function replacement		
Default setting: -	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 7/2, 2/2 for 828D	Unit: -	
Data type: STRING	Applies as of SW:		
Meaning:	Cycle name for tool change routine during call via T function. If a T function is programmed in a part program block, then the subprogram defined in T_NO_FCT_CYCLE_NAME is called at the end of block. The programmed T number can be queried in the cycle via the system variables $C_T/$C_T_PROG as decimal value and via $C_TS/$C_TS_PROG as string (only in tool management). $MN_T_NO_FCT_CYCLE_NAME acts both in the Siemens mode G290 as well as in the external language mode G291. $MN_M_NO_FCT_CYCLE_NAME and $MN_T_NO_FCT_CYCLE_NAME may not be effective in one block at the same time, i.e. max. one M/T function replacement can be effective per block. Neither an M98 nor a modal subprogram call may be programmed in the block with the T function replacement. A subprogram return jump or end of part program is also not permitted. Alarm 14016 is generated if these conventions are not observed.		
Corresponds to:	MD10715 $MN_M_NO_FCT_CYCLE MD10716 $MN_M_NO_FCT_CYCLE_NAME		

10718	M_NO_FCT_CYCLE_PAR		
MD number	M function replacement with parameters		
Default setting: -1	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 7/2, 2/2 for 828D	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	If a M function replacement was configured with $MN_M_NO_FCT_CYCLE[n], $MN_M_NO_FCT_CYCLE_NAME[n], then $MN_M_NO_FCT_CYCLE_PAR can be used to specify a parameter transfer for one of these M functions per system variable as is the case for the T function replacement. The parameters stored in the system variables always refer to the part program line in which the M function to be replaced is programmed. The following system variables are available: $C_ME: Address extension of the substituted M function $C_T_PROG: TRUE if address T has been programmed $C_T: Value of address T (integer) $C_TE: Address extension of address T $C_TS_PROG: TRUE if address TS has been programmed $C_TS: Value of address TS (string, with tool management only) $C_D_PROG: TRUE if address D has been programmed $C_D: Value of address D $C_DL_PROG: TRUE if address DL has been programmed $C_DL: Value of address DL		

10719	T_NO_FCT_CYCLE_MODE		
MD number	Parameter assignment for T function replacement		
Default setting: 0	Min. input limit: 0	Max. input limit: 7	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	This machine datum is used to assign parameters for processing the substitution subprogram for the tool and/or tool compensation selection. Bit 0 = 0: D or DL number is transferred to the substitution subprogram (default value) Bit 0 = 1: The D or DL number is not transferred to the substitution subprogram if the following conditions are fulfilled: $MC_TOOL_CHANGE_MODE = 1 Programming of D/DL with T or M function with which the tool change cycle is called, in a part program block line Bit 1 = 0 Processing of substitution subprogram at end of block (default value) Bit 1 = 1 Processing of substitution subprogram at start of block Bit 2 = 0: Processing of substitution subprogram according to setting for bit 1 Bit 2 = 1: Processing of substitution subprogram at start of block and at end of block		

10760	G53_TOOLCORR		
MD number	Method of functioning with G53, G153 and SUPA		
Default setting: 0	Min. input limit: 0	Max. input limit: 3	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: BOOLEAN	Applies as of SW:		
Meaning:	This machine datum is used to define whether tool length and tool radius compensations are also to be suppressed in the language commands G53, G153 and SUPA. The machine datum is bit-coded. Bit 0 = 0: G53, G153 and SUPA is a non-modal suppression of work offsets. Active tool length and tool radius compensation is retained. Bit 0 = 1: G53, G153 and SUPA is a non-modal suppression of work offsets, active tool length and tool radius compensation. Bit 1 = 0: If bit 0 is set, the tool length is always suppressed for G53, G153 and SUPA. Bit 1 = 1: If bit 0 is set, the tool length is only suppressed for G53, G153 and SUPA if a cutting edge is selected but not in the same block (this may even be the cutting edge which is already active).		

10800	EXTERN_CHAN_SYNC_M_NO_MIN		
MD number	1st M function for channel synchronization		
Default setting: -1	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	M number of the first M function with which channel program synchronization can be undertaken in ISO2/3 mode. In order to avoid conflicts with standard M functions, 100 is the smallest value permitted. If a value between 0 - 99 is entered, alarm 4170 is output.		

10802	EXTERN_CHAN_SYNC_M_NO_MAX		
SD number	Last M function for channel synchronization		
Default setting: -1	Min. input limit: -	Max. input limit:	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	M number of the last M function with which channel program synchronization can be undertaken in ISO2/3 mode. Along with $MN_EXTERN_CHAN_SYNC_M_NO_MIN, the machine datum defines a range of M numbers which is reserved for channel synchronization. The range may be a maximum of 10*number of channels in size because only 10 WAIT marks may be set for each channel. If a value between 0-99 or a value less than $MN_EXTERN_CHAN_SYNC_M_NO_MIN is stated, alarm 4170 is output.		

10804	EXTERN_M_NO_SET_INT		
MD number	M function for ASUB activation		
Default setting: 96	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	M function number with which an interrupt program (ASUB) is activated in the ISO_T/M mode. The interrupt program is always started with the 1st fast NC input. The M number defined in the machine datum takes the place of M96 in the external language mode. For constraints, see MD10715 $MN_M_NO_FCT_CYCLE		
Corresponds to:	MD10814 $MN_EXTERN_M_NO_MAC_CYCLE MD10804 $MN_EXTERN_M_NO_SET_INT MD10806 $MN_EXTERN_M_NO_DISABLE_INT MD10800 $MN_EXTERN_CHAN_SYNC_M_NO_MIN MD10802 $MN_EXTERN_CHAN_SYNC_M_NO_MAX MD20095 $MC_EXTERN_RIGID_TAPPING_M_NR		

10806	EXTERN_M_NO_DISABLE_INT		
MD number	M function for ASUB deactivation		
Default setting: 97	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	M function number with which an interrupt program (ASUB) is deactivated in the ISO-T/M mode. The M number defined in the machine datum takes the place of M97 in the external language mode. For constraints, see MD10715 $MN_M_NO_FCT_CYCLE		
Corresponds to:	MD10814 $MN_EXTERN_M_NO_MAC_CYCLE MD10804 $MN_EXTERN_M_NO_SET_INT MD10806 $MN_EXTERN_M_NO_DISABLE_INT MD10800 $MN_EXTERN_CHAN_SYNC_M_NO_MIN MD10802 $MN_EXTERN_CHAN_SYNC_M_NO_MAX MD20095 $MC_EXTERN_RIGID_TAPPING_M_NR		

10808	EXTERN_INTERRUPT_BITS_M96		
MD number	Activate interrupt program (ASUB)		
Default setting: 0	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	The flow of the interrupt routine activated with M96 P. can be affected by setting the different bits. Bit 0=0: Interrupt program is not possible, M96/97 are normal M functions Bit 0=1: Activation of an interrupt program with M96/M97 is allowed Bit 1=0: Process part program with the end position of the next block after the interruption block Bit 1=1: Further process part program from the interruption position Bit 2=0: The interrupt signal interrupts the current block immediately and starts the interrupt routine Bit 2=1: The interrupt routine is started only at the end of the block Bit 3=0: Interrupt execution cycle during an interrupt signal Bit 3=1: Start interrupt program only at the end of the execution cycle		

10810	EXTERN_MEAS_G31_P_SIGNAL		
MD number	Assignment of the measuring inputs for G31 P..		
Default setting: 1	Min. input limit: 0	Max. input limit: 3	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	The machine datum is used to define an assignment of the measuring inputs 1 and 2 to the P number programmed with G31 P1 (-P4). The MD is bit-coded. Only bit 0 and bit 1 are evaluated. If, e.g. the bit 0=1 is in $MN_EXTERN_MEAS_G31_P_SIGNAL[1], it is activated with G31 P2 of the first measuring input. The second measuring input is activated with G31 P4 with $MN_EXTERN_MEAS_G31_P_SIGNAL[3] = 2. Bit 0=0: Do not evaluate measuring input 1 in G31 P1 (-P4) Bit 0=1: Activate measuring input 1 in G31 P1 (-P4) Bit 1=0: Do not evaluate measuring input 2 in G31 P1 (-P4) Bit 1=1: Activate measuring input 2 in G31 P1 (-P4)		

10812	EXTERN_DOUBLE_TURRET_ON		
MD number	Double turret head with G68		
Default setting: FALSE	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: BOOLEAN	Applies as of SW:		
Meaning:	This MD is used to define whether a double-slide machining is to be started with G68 (channel synchronization for the 1st and 2nd channel), or the second tool of a double turret (= 2, tool permanently connected at the distance defined in $SC_EXTERN_DOUBLE_TURRET_DIST setting datum) is to be activated. FALSE: Channel synchronization for double slide machining TRUE: Change 2nd tool of a double turret (= activate $SC_EXTERN_DOUBLE_TURRET_DISTANCE as additive work offset and mirroring at Z axis)		

10814	EXTERN_M_NO_MAC_CYCLE		
MD number	Macro call via M function		
Default setting: -1	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	M number with which a macro is called. The name of the subprogram is stored in $MN_EXTERN_M_NO_MAC_CYCLE_NAME[n]. If the M function is programmed in a part program block defined with $MN_EXTERN_M_NO_MAC_CYCLE[n], the subprogram defined in EXTERN_M_NO_MAC_CYCLE_NAME[n] is started, all the addresses programmed in the block are written to the associated variables. If the M function is reprogrammed in the subprogram, then there is no longer any replacement by a subprogram call. $MN_EXTERN_M_NO_MAC_CYCLE_NAME[n] operates only in the external language mode G291. The subprograms configured with $MN_EXTERN_M_NO_MAC_CYCLE_NAME[n] may not be effective in one block (part program line) at the same time, i.e. max. one M function replacement can be effective per block. Neither an M98 nor a modal subprogram call may be programmed in the block with the M function replacement. A subprogram return jump or end of part program is also not permitted. Alarm 14016 is generated if these conventions are not observed. For constraints, see machine datum 10715 $MN_M_NO_FCT_CYCLE		
Corresponds to:	MD10814 $MN_EXTERN_M_NO_MAC_CYCLE MD10804 $MN_EXTERN_M_NO_SET_INT MD10806 $MN_EXTERN_M_NO_DISABLE_INT MD10800 $MN_EXTERN_CHAN_SYNC_M_NO_MIN MD10802 $MN_EXTERN_CHAN_SYNC_M_NO_MAX MD20095 $MC_EXTERN_RIGID_TAPPING_M_NR		

10815	EXTERN_M_NO_MAC_CYCLE_NAME		
MD number	Subprogram name for macro call via M function		
Default setting:	Min. input limit:	Max. input limit:	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: STRING	Applies as of SW:		
Meaning:	Name of subprogram which is started during call via the M function defined with $MN_EXTERN_M_NO_MAC_CYCLE[n].		

10816	EXTERN_G_NO_MAC_CYCLE		
MD number	Macro call via G function		
Default setting: -1	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: DOUBLE	Applies as of SW:		
Meaning:	G number with which a macro is called. The name of the subprogram is stored in $MN_EXTERN_G_NO_MAC_CYCLE_NAME[n]. If a G function defined with $MN_EXTERN_M_NO_MAC_CYCLE[n] is programmed in a part program block, the subprogram defined in EXTERN_M_NO_MAC_CYCLE_NAME[n] is started, all the addresses programmed in the block are written in the related $C_xx variable. If a subprogram call is already active via an M/G macro or an M substitution, no subprogram call is executed. If in this case a standard G function is programmed, then it is executed, otherwise alarm 12470 is output. $MN_EXTERN_G_NO_MAC_CYCLE[n] acts only in the external language mode G291. In one block there may only be one subprogram call. That is, in one block only one M/G function replacement may be programmed and there may be no additional subprogram calls (M98) or cycle calls in the block. A subprogram return jump or end of part program is also not permitted in the same block. Alarm 14016 is generated if these conventions are not observed.		

10817	EXTERN_G_NO_MAC_CYCLE_NAME		
MD number	Subprogram name for macro call via G function		
Default setting: -	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: STRING	Applies as of SW:		
Meaning:	Name of subprogram which is started during call via the H function defined with $MN_EXTERN_G_NO_MAC_CYCLE[n].		

10818	EXTERN_INTERRUPT_NUM_ASUP		
MD number	Interrupt number for ASUB start (M96)		
Default setting: 1	Min. input limit: 1	Max. input limit: 8	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	Number of the interrupt input with which an asynchronous subprogram activated in the ISO mode is started. (M96< Program number>)		

10820	EXTERN_INTERRUPT_NUM_RETRAC		
MD number	Interrupt number for rapid retraction (G10.6)		
Default setting: 2	Min. input limit: 1	Max. input limit: 8	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	Number of the interrupt input with which a rapid retraction is triggered in ISO mode at the position programmed with G10.6.		

10880	MM_EXTERN_CNC_SYSTEM		
MD number	Definition of the control system to be adapted		
Default setting: 1	Min. input limit: 1	Max. input limit: 5	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	Definition of external CNC system, the part programs of which are to be processed on the SINUMERIK control alongside SINUMERIK code (ISO_1): 1: ISO_2.1: System Fanuc0 Milling (shared compensation memory) 2: ISO_3.1: System Fanuc0 Turning (shared compensation memory) 3: External language using OEM application 4: ISO_2.2: System Fanuc0 Milling (separate compensation memory) 5: ISO_3.2: System Fanuc0 Turning (separate compensation memory)		

10881	MM_EXTERN_GCODE_SYSTEM		
SD number	ISO mode T: G code system		
Default setting: 0	Min. input limit: 0	Max. input limit: 2	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	Determination of the G code system, which is to be processed actively in ISO dialect T mode: Value = 0: ISO_T: Code system B Value = 1: ISO_T: Code system A Value = 2: ISO_T: Code system C In order for the shell cycle to work in the correct G code system, the corresponding system must be entered in the GUD variable _ZSFI[39].		

10882	NC_USER_EXTERN_GCODES_TAB [n]:0...59		
MD number	List of user-specific G commands of an external NC language		
Default setting: -	Min. input limit: -	Max. input limit: -	
Changes effective after POWER ON	Protection level: 2/2	Unit: -	
Data type: STRING	Applies as of SW:		
Meaning:	List of G commands reconfigured by the user, external NC languages. The G commands realized can be found in the current Siemens documentation for this programming language. The list should be structured as follows: Even address: G command to change Followed by odd address: New G command Only G codes, e.g.: G20, G71 can be reconfigured.		

10884	EXTERN_FLOATINGPOINT_PROG		
MD number	Evaluation of programmed values without decimal point		
Default setting: TRUE	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: BOOLEAN	Applies as of SW:		
Meaning:	This machine datum is used to define how programmed values without decimal points are evaluated: 0: Values without a decimal point are interpreted in internal units, e.g. X1000 = 1mm (with 0.001mm input resolution) X1000.0 = 1000 mm 1: Values without a decimal point are interpreted as mm, inch or degree, e.g. X1000 = 1000 mm, X1000.0 = 1000 mm		

10886	EXTERN_INCREMENT_SYSTEM	
MD number	Increment system in external language mode	
Default setting: FALSE	Min. input limit: -	Max. input limit: -
Changes effective after power on	Protection level: 7/2	Unit: -
Data type: BOOLEAN	Applies as of SW:	
Meaning:	This machine datum is effective for external programming languages, i.e. if MD 18800 MM_EXTERN_LANGUAGE = 1. This machine datum is used to define which increment system is active. 0: Increment system IS-B= 0.001 mm/degree, = 0.0001 inch 1: Increment system IS-B= 0.0001 mm/degree, = 0.00001 inch	
Corresponds to:	MD10884 EXTERN_FLOATINGPOINT_PROG	

10888	EXTERN_DIGITS_TOOL_NO	
MD number	Number of digits for tool number in ISO mode	
Default setting: 2	Min. input limit: 0	Max. input limit: 8
Changes effective after power on	Protection level: 7/2	Unit: -
Data type: BYTE	Applies as of SW:	
Meaning:	The machine datum is active only in $MN_EXTERN_CNC_SYSTEM == 2. Number of digits in tool number in the programmed T value. The number of leading digits specified as tool number is interpreted with $MN_EXTERN_DIGITS_TOOL_NO from the programmed T value. The following digits address the compensation memory.	

10889	EXTERN_DIGITS_OFFSET_NO	
MD number	Number of digits for compensation numbers in ISO mode	
Default setting: 0, for 828D TE61/TE81: 2	Min. input limit: 0	Max. input limit: 8
Changes effective after power on	Protection level: 7/2	Unit: -

10889	EXTERN_DIGITS_OFFSET_NO
Data type: BYTE	Applies as of SW:
Meaning:	Applies to ISO mode T only. The machine datum states the digits of the compensation number which are programmed in the T word along with the tool number. The compensation number digits are counted from the T word from the right, the rest is the tool number. This MD takes precedence over $MN_EXTERN_TOOL_NO, if both MD have a value < > 0, $MN_EXTERN_OFFSET_NO is active. Value 0: The function is switched off Value 1-8: T word is split into compensation number and tool number.

10890	EXTERN_TOOLPROG_MODE		
MD number	Tool change program of external language		
Default setting: 0	Min. input limit: -	Max. input limit: -	
Changes effective after power on	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	Configuration of the programing of the tool change for external programming language: Bit 0 = 0: Effective only in case of $MN_MM_EXTERN_CNC_LANGUAGE = 2: The tool number and the compensation number are programmed in the T value. $MN_DIGITS_TOOLNO determines the number of leading digits which form the tool number. Example: $MN_DIGITS_TOOL_NO = 2 T=1234 ; tool number 12, ;compensation number 34 Bit 0 = 1: Effective only in case of $MN_MM_EXTERN_CNC_LANGUAGE = 2: Only the tool number is programmed in the T value. Compensation number == tool number. $MN_DIGITS_TOOL_NO is irrelevant. Example: T=12 ; tool number 12 ;compensation number 12 Bit 1 = 0: Effective only in case of $MN_MM_EXTERN_CNC_LANGUAGE = 2: If the number of digits programmed in the T value is the same as the number defined in $MN_EXTERN_DIGITS_TOOL_NO, then leading 0 are added. Bit 1 = 1: Effective only in case of $MN_MM_EXTERN_CNC_LANGUAGE = 2: If the number of digits programmed in the T value is the same as the number of digits specified in $MN_EXTERN_DIGITS_TOOL_NO, then the programmed number is applicable as offset and tool number Bit 2 = 0: Effective only in case of $MN_MM_EXTERN_CNC_LANGUAGE = 2: ISO T compensation selection only with D (Siemens cutting edge number) Bit 2 = 1: Effective only in case of $MN_MM_EXTERN_CNC_LANGUAGE = 2: ISO T compensation selection only with H ($TC_DPH[t,d]) Bit 6 = 0: The compensation memory for tool length and tool radius are coupled such that tool length and tool radius are always selected with the H or D programming. Bit 6 = 1: The compensation memory for tool length and tool radius are decoupled such that the tool length value number is selected with the H programming and the tool radius value number with the D programming.		

18800	MM_EXTERN_LANGUAGE		
MD number	External language is active in the control system		
Default setting: 0	Min. input limit: 0	Max. input limit: 1	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	To process part programs of other system manufacturers, one must activate the corresponding NC language. Only one external language is to be selected. The scope of commands available can be taken from the current documentation. Bit 0 (LSB): Processing of part programs ISO_2 or ISO_3. For encoding, see $MN_MM_EXTERN_CNC_SYSTEM (10880)		
MD cannot be changed for SINUMERIK 802D sl.			

7.2 Channel-specific machine data

20050	AXCONF_GEOAX_ASSIGN_TAB		
MD number	Assignment of geometry axis to channel axis		
Default setting: 1, 2, 3	Min. input limit: 0	Max. input limit: 20	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	The channel axis to which the geometry axis is assigned is specified in this MD. The assignment for all the geometry axes is to be done channel-specifically. If no assignment is defined for a geometry axis, then this geometry axis does not exist and cannot be programmed (with the names defined in MD20060 AXCONF_GEOAX_NAME_TAB). For example: Turning machine without transformation: $MC_AXCONF_GEOAX_ASSIGN_TAB[0] = 1 ; 1st geometry axis = 1st channel axis $MC_AXCONF_GEOAX_ASSIGN_TAB[1] = 0 ; 2nd geometry axis not defined $MC_AXCONF_GEOAX_ASSIGN_TAB[2] = 2 ; 3rd geometry axis = 2nd channel axis The assignment defined here is valid if no transformation is active. In case of active transformation n, the transformation-specific assignment table TRAFO_GEOAX_ASSIGN_TAB_n is active.		

20060	AXCONF_GEOAX_NAME_TAB		
MD number	Geometry axis name in channel		
Default setting: X, Y, Z	Min. input limit: -	Max. input limit: -	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: STRING	Applies as of SW:		
Meaning:	The names of the geometry axes for the channel are input separately in this MD. Geometry axes can be programmed in the part program with the names specified here. Special cases: - The geometry axis name must not clash with the designation and assignment of the machine and channel axis names. - The geometry axis name entered must not overlap with the names for the Euler angle (MD 10620: EULER_ANGLE_NAME_TAB), names for the direction vectors (MD 10640: DIR_VECTOR_NAME_TAB), names for the coordinates of the intermediate circuit point for CIP (MD 10660: INTERMEDIATE_POINT_NAME_TAB) or the names for the interpolation parameters (MD 10650: IPO_PARAM_NAME_TAB). - The geometry axis name entered must not use the following reserved address letters: - D tool compensation (D function) - E reserved - F feedrate (F function) - G distance condition - H auxiliary function (H function) - L subprogram call - M additional function (M function) - N subordinate block - P number of subprogram repetitions - R arithmetic parameter - S spindle number (S function) - T tool (T function) - Keywords (e.g. DEF, SPOS etc.) and predefined identifiers (e.g. ASPLINE, SOFT) are also not permitted. - The use of an axis identifier, consisting of a valid address letter (A, B, C, I, J, K, Q, U, V, W, X, Y, Z), followed by an optional numerical extension (1-99), offers slight benefits in the block cycle time compared with issuing a general identifier. - The geometry axes in different channels may have the same names		
Corresponds to:	MD 10000: AXCONF_MACHAX_NAME_TAB MD 20080: AXCONF_CHANAX_NAME_TAB		

20070	AXCONF_MACHAX_USED		
MD number	Machine axis number valid in channel		
Default setting: 1, 2, 3, 4	Min. input limit: 0	Max. input limit: 31	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	The machine axis to which the channel axis/special axis is assigned is input in this MD. The assignment for all the channel axes is to be done channel-specifically. A machine axis that is not assigned to any channel is not active, i.e. the axis control is not processed, the axis is not displayed on the screen and it cannot be programmed in any channel. 802D sl has 5 channel axes.		

20080	AXCONF_CHANAX_NAME_TAB		
MD number	Channel axis name in the channel		
Default setting: X, Y, Z, A, B, C, U, V, X11, Y11, ...	Min. input limit: -	Max. input limit: -	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: STRING	Applies as of SW:		
Meaning:	The name of the channel axis/special axis is entered in this MD. The first three channel axes of the three assigned geometry axes are normally filled (see also MD 20050: AXCONF_GEOAX_ASSIGN_TAB). The remaining channel axes are also denoted as special axes. The channel axis/special axis is always displayed on the monitor of WCS (workpiece coordinate system) with the names input in this MD. Special cases: - The channel axis name/special axis name entered must not clash with the designation and assignment of the machine and geometry axis names. - The channel axis name entered must not overlap with the names for the Euler angle (MD10620 $MN_EULER_ANGLE_NAME_TAB), names for direction vectors (MD10640 $MN_DIR_VECTOR_NAME_TAB), names for the coordinates of the intermediate circuit point for CIP(MD10660 $MN_INTERMEDIATE_POINT_NAME_TAB) and names for interpolation parameters (MD10650 $MN_IPO_PARAM_NAME_TAB). - The channel axis name entered must not use the following reserved address letters: - D tool compensation (D function) - E reserved - F feedrate (F function) - G distance condition - H auxiliary function (H function) - L subprogram call - M additional function (M function) - N subordinate block - P number of subprogram repetitions - R arithmetic parameter - S spindle number (S function) - T tool (T function) - Keywords (e.g. DEF, SPOS etc.) and predefined identifiers (e.g. ASPLINE, SOFT) are also not permitted. - The use of an axis identifier, consisting of a valid address letter (A, B, C, I, J, K, Q, U, V, W, X, Y, Z), followed by an optional numerical extension (1-99), offers slight benefits in the block cycle time compared with issuing a general identifier. - A unique name does not need to be entered in this MD for channel axes which are assigned geometry axes (normally the first three channel axes). Axis identifiers which are not permitted are rejected using a power up alarm. [802D]: The name of the channel axis is entered in this MD. [802D]: This name is used to indicate a channel axis in the WCS (workpiece coordinate system). This name is also written in the program. [802D]: The first two or three channel axes are usually used as geometry axes (see also MD 20050: AXCONF_GEOAX_ASSIGN_TAB). The remaining channel axes are denoted as special axes. SINUMERIK 802D sl has 5 channel axes.		

20094	SPIND_RIGID_TAPPING_M_NR		
MD number	M function for switching over to controlled axis mode		
Default setting: 70	Min. input limit: 0	Max. input limit: 0xFF	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	This machine datum defines the M auxiliary function number with which the spindle is changed over to axis mode. The M number defined in the machine datum takes the place of M70 in Siemens language mode. Note: M70 with the corresponding address extension is always output at the VDI interface as identification for the switch to axis mode. Constraints: See machine datum 10715: $MN_M_NO_FCT_		
Corresponds to:	MD10814 $MN_EXTERN_M_NO_MAC_CYCLE, MD10804 $MN_EXTERN_M_NO_SET_INT MD10806 $MN_EXTERN_M_NO_DISABLE_INT, MD 10800 $MN_EXTERN_CHAN_SYNC_M_NO_MIN, MD10802 $MN_EXTERN_CHAN_SYNC_M_NO_MAX MD20095 $MC_EXTERN_RIGID_TAPPING_M_NR		

20095	EXTERN_RIGID_TAPPING_M_NR		
MD number	M function for changing over to the controlled axis mode (external language mode)		
Default setting: 29	Min. input limit: -	Max. input limit: -	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	This machine datum defines the M function number with which a switch is to be made to controlled spindle/axis mode. The M number defined in the machine datum takes the place of M29 for external language mode. Predefined M numbers such as M00,M1,M2,M3, etc. are not permitted as M numbers. Constraints: See machine datum 10715 $MN_M_NO_FCT_.		
Corresponds to:	MD10814 $MN_EXTERN_M_NO_MAC_CYCLE, MD10804 $MN_EXTERN_M_NO_SET_INT MD10806 $MN_EXTERN_M_NO_DISABLE_INT, MD10800 $MN_EXTERN_CHAN_SYNC_M_NO_MIN, MD10802 $MN_EXTERN_CHAN_SYNC_M_NO_MAX MD20095 $MC_EXTERN_RIGID_TAPPING_M_NR		

20100	DIAMETER_AX_DEF		
MD number	Geometry axis with transverse axis functionality		
Default setting: -	Min. input limit: -	Max. input limit: -	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: STRING	Applies as of SW:		
Meaning:	The MD defines a geometry axis as transverse axis. Only one transverse axis can be defined here per channel. Other transverse axes for axis-specific diameter programming can be activated using MD30460 bit 2. The axis identifier of an active geometry axis, which has been defined by channel-specific MD20050 AXCONF_GEOAX_ASSIGN_TAB[n] or MD24120 TRAFO_AX_GEOAX_ASSIGN_TAB_1[n] (as of SW 4) and MD20060 .AXCONF_GEOAX_NAME_TAB[n], should be stated. Entering spaces or stating an axis identifier for an axis which is not defined as a geometry axis will result in the following: - During power up, alarm 4032 "Channel %1 incorrect identifier for transverse axis in %2", if the "Diameter programming (DIAMON)" function or constant cutting speed G96/G961/G962 is activated, - When activating the the "Diameter programming (DIAMON)" function, alarm 16510 "Channel %1 block %2 no transverse axis present for diameter programming", if no axis has been permitted for channel-specific diameter programming using DIAMCHANA[AX], - When programming G96/G961/G962, alarm 10870 "Channel %1 block %2 no transverse axis defined as reference axis for G96/G961/G962", if the SCC[ax] instruction has not be used to define a geometry axis as the reference axis for G96/G961/G962.		
Corresponds to:	MD20050 AXCONF_GEOAX_ASSIGN_TAB[n], MD 20060 AXCONF_GEOAX_NAME_TAB[n], MD24128 TRAFO_AX_GEOAX_ASSIGN_TAB_1[n], MD30460 BASE_FUNCTION_MASK,		

20150	GCODE_RESET_VALUES		
MD number	Reset G groups		
Default setting: 2, 0, 0, 1, 0, ...	Min. input limit: -	Max. input limit: -	
Changes effective after RESET	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	Definition of the G codes that become active during power up and reset or at a part program end and part program start. The G code index must be specified in the respective groups as preset value. Name - Group - Default value GCODE_RESET_VALUES[0] 1 2 (G01) GCODE_RESET_VALUES[1] 2 0 (inactive) GCODE_RESET_VALUES[2] 3 0 (inactive) GCODE_RESET_VALUES[3] 4 1 (START FIFO) GCODE_RESET_VALUES[4] 5 0 (inactive) GCODE_RESET_VALUES[5] 6 1 (G17) when milling GCODE_RESET_VALUES[6] 7 1 (G40) GCODE_RESET_VALUES[7] 8 1 (G500) GCODE_RESET_VALUES[8] 9 0 (inactive) GCODE_RESET_VALUES[9] 10 1 (G60) GCODE_RESET_VALUES[10] 11 0 (inactive) GCODE_RESET_VALUES[11] 12 1 (G601) GCODE_RESET_VALUES[12] 13 2 (G71) GCODE_RESET_VALUES[13] 14 1 (G90) GCODE_RESET_VALUES[14] 15 2 (G94) GCODE_RESET_VALUES[15] 16 1 (CFC)... GCODE_RESET_VALUES[16] 17 1 (NORM) GCODE_RESET_VALUES[17] 18 1 (G450) GCODE_RESET_VALUES[18] 19 1 (BNAT) GCODE_RESET_VALUES[19] 20 1 (ENAT) GCODE_RESET_VALUES[20] 21 1 (BRISK)		

20150	GCODE_RESET_VALUES
	GCODE_RESET_VALUES[21] 22 1 (RTCPOF) GCODE_RESET_VALUES[22] 23 1 (CDOF) GCODE_RESET_VALUES[23] 24 1 (FFWOF) GCODE_RESET_VALUES[24] 25 1 (ORIWKS) GCODE_RESET_VALUES[25] 26 2 (RMI) GCODE_RESET_VALUES[26] 27 1 (ORIC) GCODE_RESET_VALUES[27] 28 1 (WALIMON) GCODE_RESET_VALUES[28] 29 1 (DIAMOF) GCODE_RESET_VALUES[29] 30 1 (COMPOF) GCODE_RESET_VALUES[30] 31 1 (inactive) GCODE_RESET_VALUES[31] 32 1 (inactive) GCODE_RESET_VALUES[32] 33 1 (FTCOF) GCODE_RESET_VALUES[33] 34 1 (OSOF) GCODE_RESET_VALUES[34] 35 1 (SPOF) GCODE_RESET_VALUES[35] 36 1 (PDLAYON) GCODE_RESET_VALUES[36] 37 1 (FNOORM) GCODE_RESET_VALUES[37] 38 1 SPF1) GCODE_RESET_VALUES[38] 39 1 CPRECOF) GCODE_RESET_VALUES[39] 40 1 (CUTCONOF) GCODE_RESET_VALUES[40] 41 1 (LFOF) GCODE_RESET_VALUES[41] 42 1 (TCOABS) GCODE_RESET_VALUES[42] 43 1 (G140) GCODE_RESET_VALUES[43] 44 1 (G340)
	GCODE_RESET_VALUES[44] 45 1 (SPATH) GCODE_RESET_VALUES[45] 46 1 (LFTXT) GCODE_RESET_VALUES[46] 47 1 (G290 SINUMERIK_MODE) GCODE_RESET_VALUES[47] 48 3 (G462) GCODE_RESET_VALUES[48] 49 1 (CP) GCODE_RESET_VALUES[49] 50 1 (ORIEULER) GCODE_RESET_VALUES[50] 51 1 (ORIVECT) GCODE_RESET_VALUES[51] 52 1 (PAROTOF) GCODE_RESET_VALUES[52] 53 1 (TOROTOF) GCODE_RESET_VALUES[53] 54 1 (ORIROTA) GCODE_RESET_VALUES[54] 55 1 (RTLION) GCODE_RESET_VALUES[55] 56 1 (TOWSTD) GCODE_RESET_VALUES[56] 57 1 (FENDNORM) GCODE_RESET_VALUES[57] 58 1 RELIEVEON) GCODE_RESET_VALUES[58] 59 1 (DYNNORM) GCODE_RESET_VALUES[59] 60 1 (WALCSO) GCODE_RESET_VALUES[60] 61 1 (ORISOF) :: GCODE_RESET_VALUES[69] 70 1 not defined)

20152	GCODE_RESET_MODE		
MD number	Reset behavior of G groups		
Default setting:	Min. input limit: 0	Max. input limit: 1	
Changes effective after RESET	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	This machine datum is only evaluated if bit 0 is set in $MC_RESET_MODE_MASK. This MD is used to define for each entry in MD $MN_GCODE_RESET_VALUES (i.e., for each G group), whether a setting according to the $MC_GCODE_RESET_VALUES is undertaken again for a reset/part program end (MD = 0) or whether the current setting is retained (MD = 1). Example: The normal position of the 6th G group (current level) is read from the MD $MC_GCODE_RESET_VALUES for each reset/part program end here: $MC_GCODE_RESET_VALUE(5)=1; Reset value of 6th G group is M17 $MC_GCODE_RESET_MODE(5)=0; Normal position of the 6th G group after reset/part program end is according to $MC_GCODE_RESET_VALUES(5) However, if the current setting of the 6th G group (current level) is to be retained beyond reset/part program end, then we have the following setting: $MC_GCODE_RESET_VALUE(5)=1; Reset value of 6th G group is M17 $MC_GCODE_RESET_MODE(5)=1; current setting of the 6th G group end is retained even after reset/part program		
Corresponds to:	MD20110 $MC_RESET_MODE_MASK MD 20112 $MC_START_MODE_MASK		

20154	**EXTERN_GCODE_RESET_VALUES[n]: 0, ..., 30**		
MD number	Reset G groups in ISO mode		
Default setting: 1,1,1,1,2,1,1...	Min. input limit: -	Max. input limit: -	
Changes effective after RESET	Protection level: 2/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	When using an external NC programming language, definition of the G codes which are effective during a power up and reset and/or at the end of a part program depending on MD20110 $MC_RESET_MODE_MASK and at the start of a part program depending on MD20112 $MC_START_MODE_MASK The following external programming languages are possible: • ISO dialect milling • ISO dialect turning The G group classification to be used is taken from the current SINUMERIK documentation. The following groups can be written within the MD20154 EXTERN_GCODE_RESET_VALUES: **ISO dialect M:** G group 2: G17/G18/G19 G group 3: G90/G91 G group 5: G94/G95 G group 6: G20/G21 G group 13: G96/G97 G group 14: G54-G59 **ISO dialect T:** G group 2: G96/G97 G group 3: G90/G91 G group 5: G94/G95 G group 6: G20/G21 G group 16: G17/G18/G19		

20156	EXTERN_GCODE_RESET_MODE		
MD number	Reset behavior of external G groups		
Default setting: 0	Min. input limit: 0	Max. input limit: 1	
Changes effective after RESET	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	This MD is only evaluated if bit 0 is set in MD20110 $MC_RESET_MODE_MASK (see there)! This MD is used to define for each entry in MD20154 $MN_EXTERN_GCODE_RESET_VALUES (i.e., for each G group), whether a setting according to the MD $MC_EXTERN_GCODE_RESET_VALUES is undertaken again for a reset/part program end (MD=0) or whether the current setting is retained (MD=1). Example of ISO dialect mode: The normal position of the 14th G group (adjustable work offset) is read from the machine datum $MC_EXTERN_GCODE_RESET_VALUES for each reset/part program end here: $MC_EXTERN_GCODE_RESET_VALUES[13]=1 ;Reset value of the 14th group is G54 $MC_EXTERN_GCODE_RESET_VALUES(13)=0; Normal position of the 14th G group after reset/part program end is defined via $MC_EXTERN_GCODE_RESET_VALUES[13] However, if the current setting of the 14th G group is to be retained beyond reset/part program end, then we have the following setting: $MC_EXTERN_GCODE_RESET_VALUES[13]=1 ;Reset value of the 14th group is G54 $MC_G_CODE_GCODE_RESET_VALUES(13)=0; current setting of the 14th G group is retained even after reset/part program end		

20380	TOOL_CORR_MODE_G43/G44		
MD number	Handling the tool length compensation for G43/G44		
Default setting: 0	Min. input limit: 1	Max. input limit: 2	
Changes effective after RESET	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	In ISO dialect M (G43/G44) the machine datum determines how the length compensations programmed with H are processed. 0: Mode A Tool length H always impacts on the third geometry axis (usually Z) 1: Mode B Depending on the active plane, tool length H impacts on one of the three geometry axes and in the case of G17, this is the 3rd geometry axis (usually Z) G18, this is the 2nd geometry axis (usually Y) G19, this is the 1st geometry axis (usually X) Compensation can be set up in all three geometry axes in this mode through multiple programming, i.e. activation of a component does not delete the effective length compensation which may already exist in a different axis. 2: Mode C Regardless of the active plane, the tool length impacts in the axis which was simultaneously programmed with H. The behavior is otherwise the same as for variant B.		

20382	TOOL_CORR_MOVE_MODE		
MD number	Retract the tool length compensation		
Default setting: FALSE	Min. input limit: -	Max. input limit: -	
Changes effective after RESET	Protection level: 7/2	Unit: -	
Data type: BOOLEAN	Applies as of SW:		
Meaning:	The machine datum determines how the tool length compensations are retracted. 0: A tool length component is retracted only if the associated axis was programmed (behavior as in earlier software versions) 1: Tool lengths are always retracted immediately irrespective of whether or not the associated axes are programmed.		

20732	EXTERN_G0_LINEAR_MODE		
MD number	Interpolation behavior with G00		
Default setting: TRUE	Min. input limit: -	Max. input limit: -	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: BOOLEAN	Applies as of SW:		
Meaning:	This MD is used to define the interpolation behavior for G00. 0: Axes are traversed as positioning axes 1: Mutual axis interpolation		
Corresponds to:	MD10886 $MN_EXTERN_INCREMENT_SYSTEM		

20734	EXTERN_FUNCTION_MASK		
MD number	Function mask for external language		
Default setting: 0	Min. input limit: 0	Max. input limit: 0xFFFF	
Changes effective after RESET	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	Functions in ISO mode are affected by this machine datum. Bit 0=0: ISO mode T: A" and "C" are interpreted as axes. If contour definition is programmed, there must be a comma before "A" or "C". Bit 0=1: "A" and "C" in the part program are always interpreted as contour definition. There must not be an "A" or "C" axis. Bit 1=0: ISO mode T: G10 P<100 tool geometry P>100 tool wear Bit 1=1: G10 P<10 000 tool geometry P>10 000 tool wear Bit 2=0: Dwell time G04: Always [s] or [ms] Bit 2=1: If G95 is active, dwell time is in spindle revolutions Bit 3=0: Errors in the ISO scanner lead to alarm Example: N5 G291 ; ISO dialect mode N10 WAIT ; Alarm 12080 "WAIT unknown" N15 G91 G500 ; Alarm 12080 "G500 unknown" Bit 3=1: Errors in the ISO scanner are not output, the block is forwarded to the Siemens Translator Example: N5 G291 ; ISO dialect mode N10 WAIT ; Block is processed by Siemens Translator N15 G91 G500 ; Block is processed by Siemens Translator N20 X Y ; block is processed by ISO Translator due to G291, ; G91 from N15 is active Bit 4=0: G00 is traversed with the current exact stop - continuous-path mode G code. Example: In G64, even G00 blocks are traversed with G64 Bit 4=1: G00 blocks are always traversed with G09, even if G64 is active Bit 5=0: Modular axis is positioned at the shortest distance Bit 5=1: Direction of rotation for modular axis depends on sign Bit 6=0: 4-digit program numbers only permitted Bit 6=1: 8-digit program numbers permitted. If there are less than 4 digits, the figure is increased to 4 digits using 0s. Bit 7=0: Axis programming for geometry axis interchange/parallel axes is compatible with the ISO mode Bit 7=1: Axis programming for geometry axis interchange/parallel axes is compatible with the Siemens mode, in the ISO mode Bit 8=0: For cycles, the F value is always transferred interpreted as feedrate Bit 8=1: For threading cycles, the F value is always transferred interpreted as lead		
	Bit 9=0: With ISO mode T for G84, G88 in the standard mode F for G95 is multiplied by 0.01 mm or 0.0001 inch Bit 9=1: With ISO mode T for G84, G88 in the standard mode F for G95 is multiplied by 0.01 mm or 0.0001 inch Bit 10=0: In M96 Pxx, during interrupt, the program with Pxx progr. Program called. Bit 10=1: In M96 Pxx, CUCLE396.spf is always called in case of interrupt. Bit 11=0: G54.1 is displayed during the programming of G54 Pxx. Bit 11=1: G54Px is always displayed while programming G54 Pxx or G54.1 Px. Bit 12=0: $P_ISO_STACK is not changed on calling the subprogram defined with M96 Pxx. Bit 12=1: $P_ISO_STACK is incremented on calling the subprogram defined with M96 Pxx. Bit 13=0: G10 is executed without internal STOPRE Bit 13=1: G10 is executed with internal STOPRE Bit 14 = 0: ISO dialect T: No alarm if a cutting edge has been programmed in the T command. Bit 14 = 1: ISO dialect T: Alarm 14185, if no cutting edge has been programmed in the T command.		

22420	FGROUP_DEFAULT_AXES[n]: 0, ..., 7		
MD number	Default value for FGROUP command		
Default setting: 0	Min. input limit: -	Max. input limit: -	
Changes effective after POWER ON	Protection level: 7/7	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	One can specify up to 8 channels whose resulting speed corresponds to the programmed path feedrate. If all the 8 values are zero (default), then as before, the geometry axes recorded in MD20050 $MC_AXCONF_GEOAX_ASSIGN_TAB are active as the default setting for the FGROUP command.		

22512	EXTERN_GCODE_GROUPS_TO_PLC[n]: 0, ..., 7		
MD number	Send G code of an external NC language to PLC		
Default setting: 0	Min. input limit: -	Max. input limit: -	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	Specification of G code group of external languages whose G codes are output at NCK/PLC interface during block change/reset. The interface is updated with each block change and after RESET. Notice: There are no systems in place to ensure that a PLC user program has a block-synchronous relation between the active NC block and pending G codes at all times (example: Path mode with very short blocks).		

22515	GCODE_GROUPS_TO_PLC_MODE		
MD number	Response of the G group transfer to PLC		
Default setting: 0	Min. input limit: 0	Max. input limit: 1	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	To set the behavior of how the G groups are to be interpreted as data in the PLC. According to the current behavior (bit 0=0), the G group is the array index of a 64-byte field (DBB 208 - DBB 271). With the new behavior (Bit 0=1), the data storage in the PLC is a maximum of 8 bytes (DBB 208-DBB 215) in size. At the most, the 64th G group can therefore be reached. With this process, the array index of this byte array is identical to the index of MD22510 $MC_GCODE_GROUPS_TO_PLC[Index] and MD22512 $MC_EXTERN_GCODE_GROUPS_TO_PLC[Index]. Here, each index (0-7) should only be entered for one of the two items of machine data, the value 0 must be entered for the relevant other MD. Bit 0 (LSB) = 0: Response as before, the 64-byte field is used to display the G code. Bit 0 (LSB) = 1: The user defines the G groups for which the first 8 bytes are to be used.		

22900	STROKE_CHECK_INSIDE		
MD number	Direction (inside/outside) in which protection zone 3 is effective		
Default setting: FALSE	Min. input limit: -	Max. input limit: -	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: BOOLEAN	Applies as of SW:		
Meaning:	It is defined whether protection zone 3 is an inside protection zone or an outside protection zone. Meaning: 0: Protection zone 3 is an inside protection zone, i.e. the protection zone should not be overtraveled when working towards the interior 1: Protection zone 3 is an outside protection zone		

22910	WEIGHTING_FACTOR_FOR_SCALE		
MD number	Input resolution for scaling factor		
Default setting: FALSE	Min. input limit: -	Max. input limit: -	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: BOOLEAN	Applies as of SW:		
Meaning:	Definition of the unit for the scaling factor P and for the axial scaling factors I, J, K Meaning: 0: Scale factor in 0.001 1: Scale factor in 0.00001		
Corresponds to:	SD43120 DEFAULT_SCALE_FACTOR_AXIS SD42140 DEFAULT_SCALE_FACTOR_P		

22914	AXES_SCALE_ENABLE		
MD number	Activation for axial scaling factor (G51)		
Default setting: FALSE	Min. input limit: -	Max. input limit: -	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: BOOLEAN	Applies as of SW:		
Meaning:	Axial scaling is disconnected with this MD. Meaning: 0: Axial scaling is not possible 1: Axial scaling is possible, i.e. MD DEFAULT_SCALE_FACTOR_AXIS is effective		
Corresponds to:	SD43120 DEFAULT_SCALE_FACTOR_AXIS		

22920	EXTERN_FIXED_FEEDRATE_F1_ON		
SD number	Activation of fixed feedrate F1 - F9		
Default setting: FALSE	Min. input limit: -	Max. input limit:	
Changes effective after POWER ON	Protection level: 7/2	Unit:	
Data type: BOOLEAN	Applies as of SW:		
Meaning:	This MD is used to disconnect the fixed feedrates from SD42160 $SC_EXTERN_FIXED_FEEDRATE_F1_F9 [ ]. 0: No fixed feedrates with F1 - F9 1: The feedrates from the SD42160 $SC_EXTERN_FIXED_FEEDRATE_F1_F9 become effective with the programming of F1 - F9		

22930	EXTERN_PARALLEL_GEOAX	
SD number	Assignment of a parallel channel axis to the geometry axis	
Default setting: 0	Min. input limit: 0	Max. input limit: 20
Changes effective after POWER ON	Protection level: 7/2	Unit: -
Data type: BYTE	Applies as of SW:	
Meaning:	Assignment tables of the axes that are parallel to the geometry axes. This table can be used to assign parallel channel axes to the geometry axes. The parallel axes can then be activated with the G functions of the plane selection (G17 - G19) and the axis name of the parallel axis as geometry axis. An axis interchange can then be executed with the axis defined via MD20050 $MC_AXCONF_GEOAX_ASSIGN_TAB[ ]. Requirement: The used channel axes must be active (assigned list place in in AXCONF_MACHAX_USED). Entry of a zero deactivates the corresponding parallel geometry axis.	

24004	CHBFRAME_POWERON_MASK	
MD number	Reset channel-specific basic frames after Power On	
Default setting: 0	Min. input limit: 0	Max. input limit: 0xFFFF
Changes effective after POWER ON	Protection level: 7/2	Unit: -
Data type: DWORD	Applies as of SW:	
Meaning:	This machine datum is used to define whether channel-specific basic frames are reset to the data management during Power On Reset, i.e. - shifts and rotations are set to 0, - scaling is set to 1. - mirroring is switched off. The individual basic frames can be selected separately. Bit 0 corresponds to basic frame 0, bit 1 to basic frame 1 etc. Value = 0: Basic frame is retained at Power On Value = 1: Basic frame is reset in the data management at Power ON.	
Corresponds to:	MD10615 $MN_NCBFRAME_POWERON_MASK	

24006	CHSFRAME_RESET_MASK		
MD number	Active system frames after reset		
Default setting: 0	Min. input limit: 0	Max. input limit: 0x7FF	
Changes effective after RESET	Protection level: 2/7, 1/1 for 828D	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	Bit mask for the reset setting of the channel-specific system frames calculated in the channel. Bit: 0: System frame for actual value setting and scratching is active after reset. 1: System frame for external work offset is active after reset. 2: Reserved, TCARR and PAROT refer to $MC_GCODE_RESET_VALUES[ ]. 3: Reserved, TOROT and TORFRAME refer to $MC_GCODE_RESET_VALUES[ ]. 4: System frame for workpiece reference points is active after reset. 5: System frame for cycles is active after reset. 6: Reserved, reset behavior depends on $MC_RESET_MODE_MASK. 7: System frame $P_ISO1FR (ISO G51.1 Mirror) is active after reset. 8: System frame $P_ISO2FR (ISO G68 2DROT) is active after reset. 9: System frame $P_ISO3FR (ISO G68 3DROT) is active after reset. 10: System frame $P_ISO4FR (ISO G51 Scale) is active after reset. 11: System frame $P_RELFR is active after reset.		
Corresponds to:	MD 28082: MM_SYSTEM_FRAME_MASK		

28080	NUM_USER_FRAMES		
MD number	Number of adjustable frames (SRAM)		
Default setting: 5	Min. input limit: 5	Max. input limit: 100	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	Defines the number of predefined user frames. Around 400 bytes of the buffered memory are reserved per frame. The system includes four frames for G54 to G57 and one frame for G500 as standard. Special cases: If this machine datum is altered the buffered data is lost.		

28082	MM_SYSTEM_FRAME_MASK		
MD number	System frames (SRAM)		
Default setting: 0x21, 0x21,...	Min. input limit: 0	Max. input limit: 0000000x7FF	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	Bit mask for the configuration of the channel-specific system frames calculated in the channel. Bit: 0: System frame for actual value setting and scratching 1: System frame for external work offset 2: System frame for TCARR and PAROT 3: System frame for TOROT and TORFRAME 4: System frame for workpiece reference points 5: System frame for cycles 6: System frame for transformations 7: System frame for $P_ISO1FR for ISO G51.1 Mirror 8: System frame for $P_ISO2FR for ISO G68 2DROT 9: System frame for $P_ISO3FR for ISO G68 3DROT 10: System frame for $P_ISO4FR for ISO G51 Scale 11: System frame $P_RELFR for relative coordinate systems		

28210	MM_NUM_PROTECT_AREA_ACTIVE		
MD number	Number of simultaneously active protection zones in one channel		
Default setting: 0	Min. input limit: 0	Max. input limit: 10	
Changes effective after POWER ON	Protection level: 7/2	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	This machine datum states how many protection zones may be activated at the same time for each channel. A numerical value greater than MD18190 MM_NUM_PROTECT_AREA_NCK + MD28200 MM_NUM_PROTECT_AREA_CHAN is not recommended.		
Corresponds to:	MD28200 MM_NUM_PROTECT_AREA_CHAN MD18190 MM_NUM_PROTECT_AREA_NCK		

7.3 Axis-specific machine data

34100	REFP_SET_POS		
MD number	Home position value/destination point for distance-coded system		
Default setting: 0	Min. input limit: -45000000	Max. input limit: +45000000	
Changes effective after RESET	Protection level: 7/2	Unit: mm, degrees	
Data type: DOUBLE	Applies as of SW:		
Meaning:	- Incremental encoder with zero mark(s): The position value which is set as the current axis position after the zero mark has been detected and after traversing distance REFP_MOVE_DIST + REFP_MOVE_DIST_CORR (relative to zero mark). REFP_SET_POS of the home position number set at the time of the positive edge of the reference cam signal (NC/PLC interface signal (home position value 1-4)) is set as the axis position. - Distance-coded measuring system: Target position which is approached when REFP_STO_AT_ABS_MARKER is set to 0 (FALSE) and two zero marks have been passed. - Absolute value encoder: MD34100 REFP_SET_POS corresponds to the current actual value at the adjustment position. The reaction on the machine depends on the status of MD34210 ENC_REFP_STATE: When ENC_REFP_STATE = 1, the value of REFP_SET_POS is taken as the absolute value. When ENC_REFP_STATE = 2 and MD34330 REFP_STOP_AT_ABS_MARKER = 0 (FALSE), the axis approaches the target position saved in REFP_SET_POS. The value of REFP_SET_POS which is set using (NC/PLC interface signal (home position value 1-4)) is used.		

35100	SPIND_ASSIGN_TO_MACHAX		
MD number	Assignment of spindle to machine axis		
Default setting: 0	Min. input limit: 0	Max. input limit: 20	
Changes effective after POWER ON	Protection level: 7/2	Unit: mm, degrees	
Data type: BYTE	Applies as of SW:		
Meaning:	Definition of the spindle. The spindle is defined when the spindle number is entered in this MD. Example: If the axis in question is to be spindle 1, "1" should be entered in this MD. The spindle functions are only available for modulo rotary axes. MD 30300 IS_ROT_AX and MD30310 ROT_IS_MODULO should be set for this purpose. The axis functionality is retained, the transition to axis mode can be made using M70. The spindle data is set for specific gear levels in parameter sets 1...5, parameter set 0 is used in axis mode (MD35590 PARAMSET_CHANGE_ENABLE). The minimum spindle number is 1, the maximum number depends on the number of axes in the channel. If other spindle numbers are to be issued, the "spindle converter" function should be used. In multiple-channel systems, the same numbers can be issued in all channels other than for spindles which are registered in several channels (interchange axes/spindles MD30550 AXCOF_ASSIGN_MASTER_CHAN).		

7.4 Channel-specific setting data

42110	DEFAULT_FEED		
SD number	Default value for path feedrate		
Default setting: 0	Min. input limit: -	Max. input limit: -	
Change valid IMMEDIATELY	Protection level: 7/7	Unit: -	
Data type: DOUBLE	Applies as of SW:		
Meaning:	The setting datum is evaluated at the part program start, giving due consideration to the feedrate type active at this point of time (refer to MD20150 $MC_GCODE_RESET_VALUES or MD20154 $MC_EXTERN_GCODE_RESET_VALUES).		

42140	DEFAULT_SCALE_FACTOR_P		
SD number	Default scaling factor for address P		
Default setting: 1	Min. input limit: -	Max. input limit: -	
Change valid IMMEDIATELY	Protection level: 7/7	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	If no scaling factor P is programmed in the block, then the value from this machine datum is active.		

42150	DEFAULT_ROT_FACTOR_R		
SD number	Default rotation factor for address R		
Default setting: 0	Min. input limit: -	Max. input limit: -	
Change valid IMMEDIATELY	Protection level: 7/7	Unit: -	
Data type: DOUBLE	Applies as of SW:		
Meaning:	If a factor has not been programmed in the block for rotation R, the value from this setting datum is effective.		

42160	EXTERN_FIXED_FEEDRATE_F1_F9		
SD number	Fixed feedrates F1 - F9		
Default setting: 0	Min. input limit: -	Max. input limit: -	
Change valid IMMEDIATELY	Protection level: 7/7	Unit: -	
Data type: DOUBLE	Applies as of SW:		
Meaning:	Fixed feedrate values for the programming with F1 -F9. If the machine datum $MC_FEEDRATE_F1_F9 = TRUE is set, the feedrate values from the setting datum SD42160 $SC_EXTERN_FIXED_FEEDRATE_F1_F9[0] - $SC_EXTERN_FIXED_FEEDRATE_F1_F9[8] are read and activated as machining feedrate with the programming of F1 to F9. The rapid traverse feedrate must be entered in SD42160 $SC_EXTERN_FIXED_FEEDRATE_F1_F9[0].		

42162	EXTERN_DOUBLE_TURRET_DIST		
SD number	Tool distance of double turret head		
Default setting: 0	Min. input limit: -	Max. input limit:	
Change valid IMMEDIATELY	Protection level: 7/7	Unit: -	
Data type: DOUBLE	Applies as of SW:		
Meaning:	Distance between two tools of one double slide turret head. The distance is activated with G68 as additive work offset, if MD10812 $MN_EXTERN_DOUBLE_TURRET_ON = TRUE is set.		

42520	CORNER_SLOWDOWWN_START	
SD number	Start of feedrate reduction in G62	
Default setting: 0	Min. input limit: -	Max. input limit: Any
Change valid IMMEDIATELY	Protection level: 7/7	Unit: mm
Data type: DOUBLE	Applies as of SW:	
Meaning:	Path length from which the feedrate is reduced before the corner in G62	

42522	CORNER_SLOWDOWN_END	
SD number	End of feedrate reduction in G62	
Default setting: 0	Min. input limit: -	Max. input limit: Any
Change valid IMMEDIATELY	Protection level: 7/7	Unit: mm
Data type: DOUBLE	Applies as of SW:	
Meaning:	Path length up to which the feedrate remains reduced after a corner in G62.	

42524	CORNER_SLOWDOWN_OVR	
SD number	Override for feedrate reduction in G62	
Default setting: 0	Min. input limit: -	Max. input limit: -
Change valid IMMEDIATELY	Protection level: 7/7	Unit: %
Data type: DOUBLE	Applies as of SW:	
Meaning:	Override with which the feedrate is multiplied at the corner in G62.	

42526	CORNER_SLOWDOWN_CRIT	
SD number	Corner detection for G62	
Default setting: 0	Min. input limit: -	Max. input limit: -
Change valid IMMEDIATELY	Protection level: 7/7	Unit: Degr.
Data type: DOUBLE	Applies as of SW:	
Meaning:	Angle from which a corner is considered for the feedrate reduction with G62, e.g. SD42526 CORNER_SLOWDOWN_CRIT=90: All corners of 90 degrees or less are traversed slower with G62.	

42940	TOOL_LENGTH_CONST		
SD number	Change of tool length component for change of plane		
Default setting: 0	Min. input limit: -	Max. input limit: -	
Change valid IMMEDIATELY	Protection level: 7/7	Unit:	
Data type: DWORD	Applies as of SW:		

Meaning:

If this setting datum is not zero, the assignment of tool lengths 1 to 3 (length, wear) to the geometry axes when changing machining plane (G17 to G19) is not changed.
The assignment of tool length components to geometry axes results from the setting datum value according to the table below.
During assignment, a distinction is made between turning and grinding tools (tool types 400 to 599) and other tools (typically milling tools).
The representation in the tables assumes that geometry axes 1 to 3 are identified as X, Y and Z. The axis order and not the axis identifier determines the assignment between a compensation and an axis.

Assignment for turning and grinding tools (tool type 400 to 599):

Content	Length 1	Length 2	Length 3
17	Y	X	Z
18*)	X	Z	Y
19	Z	Y	X
-17	X	Y	Z
-18	Z	X	Y
-19	Y	Z	X

* Each value not equal to 0, which is not equal to one of the six listed values, is evaluated as value 18. If values are of the same amount but have different signs, the assignment of length 3 is the same and lengths 1 and 2 are swapped. Assignment for all tools which are not turning or grinding tools (tool types < 400 or > 599):

Content	Length 1	Length 2	Length 3
17*)	Z	Y	X
18	Y	X	Z
19	X	Z	Y
-17	Z	X	Y
-18	Y	Z	X
-19	X	Y	Z

* Each value not equal to 0, which is not equal to one of the six listed values, is evaluated as value 17.

If values are of the same amount but have different signs, the assignment of length 1 is the same and lengths 2 and 3 are swapped.

42950	TOOL_LENGTH_TYPE		
SD number	Assignment of the tool length compensation independent of tool type		
Default setting: 0	Min. input limit: 0	Max. input limit: 2	
Change valid IMMEDIATELY	Protection level: 7/7	Unit:	
Data type: DWORD	Applies as of SW:		
Meaning:	This setting datum defines the assignment of tool length components to geometry axes regardless of tool type. Values between 0 and 2 can be accepted. Any other value is interpreted as 0. 0: The assignment is performed by default. A distinction is made between turning tools (tool types 400 to 599) and other tools (milling tools). 1: The assignment of the tool length components is, independent of the actual tool type, always the same as for milling tools. 2: The assignment of the tool length components is, independent of the actual tool type, always the same as for turning tools. The setting datum also affects the wear values assigned to length components. If SD42940 $SC_TOOL_LENGTH_CONST is set, the table for milling and/or turning tools defined by SD42950 $SC_TOOL_LENGTH_TYPE is accessed in the tables defined there regardless of the actual tool type if the value of the turning tools is not 0.		

42990	MAX_BLOCKS_IN_IPOBUFFER		
SD number	Max. number of blocks in the IPO buffer		
Default setting: -1	Min. input limit: -	Max. input limit: -	
Change valid IMMEDIATELY	Protection level: 7/7	Unit:	
Data type: DWORD	Applies as of SW:		
Meaning:	This setting datum can be used to limit the maximum number of blocks in the interpolation buffer. The maximum number is defined by MD28060 MM_IPO_BUFFER_SIZE. A negative value means that the number of blocks in the IPO buffer is not limited and the number of blocks is determined by MD MM_IPO_BUFFER_SIZE alone (standard setting).		

42995	CONE_ANGEL		
SD number	Taper angle		
Default setting: 0	Min. input limit: -90	Max. input limit: +90	
Change valid IMMEDIATELY	Protection level: 7/7	Unit: Degr.	
Data type: DOUBLE	Applies as of SW:		
Meaning:	This setting datum describes the taper angle for taper turning. This setting datum is written using the user interface.		

7.5 Axis-specific setting data

43120	DEFAULT_SCALE_FACTOR_AXIS		
MD number	Default axial scaling factor with active G51		
Default setting: 1	Min. input limit: -	Max. input limit:	
Change valid IMMEDIATELY	Protection level: 7/7	Unit: -	
Data type: DWORD	Applies as of SW:		
Meaning:	If no axial scaling factor I, J or K is programmed in the G51 block, then the SD43120 DEFAULT_SCALEFACTOR_AXIS is active. For the scaling factor to be effective, the MD22914 AXES_SCALE_ENABLE must be set.		
Corresponds to:	MD22914 AXES_SCALE_ENABLE		

43240	M19_SPOS	
MD number	Spindle position for spindle positioning with M19	
Default setting: 0	Min. input limit: -359999	Max. input limit: 359999
Change valid IMMEDIATELY	Protection level: 7/7	Unit: Degr.
Data type: DOUBLE	Applies as of SW:	
Meaning:	Spindle position in [degrees] for spindle positioning with M19. The position approach mode is defined in $A_M19_SPOSMODE. Position specifications must be in the range 0<pos<$MA_MODULO_RANGE. Path specifications ($SA_M19_SPOSMODE = 2) may be positive or negative and are restricted by input format alone	

43340	EXTERN_REF_POSITION_G30_1	
SD number	Home position for G30.1	
Default setting: 0.0	Min. input limit:	Max. input limit:
Change valid IMMEDIATELY	Protection level: 7/7	Unit:
Data type: DOUBLE	Applies as of SW:	
Meaning:	Home position for G30.1. This setting datum is evaluated in CYCLE328.	

7.6 Channel-specific cycle machine data

52800	ISO_M_ENABLE_POLAR_COORD	
SD number	Polar coordinates	
Default setting: 0	Min. input limit: 0	Max. input limit: 1
Change valid IMMEDIATELY	Protection level: 7/3	Unit: -
Data type: BYTE	Applies as of SW:	
Meaning:	Polar coordinates 0: OFF 1: ON	

52802	ISO_ENABLE_INTERRUPTS		
SD number	Interrupt processing		
Default setting: 0	Min. input limit: 0	Max. input limit: 1	
Change valid IMMEDIATELY	Protection level: 7/3	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	Interrupt processing 0: OFF 1: ON		

52804	ISO_ENABLE_DRYRUN		
SD number	Processing skip during DRYRUN		
Default setting: 0	Min. input limit: 0	Max. input limit: 1	
Change valid IMMEDIATELY	Protection level: 7/3	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	Processing skip when tapping G74/G84 during DRYRUN 0: OFF 1: ON		

52806	ISO_SCALING_SYSTEM		
SD number	Basic system		
Default setting: 0	Min. input limit: 0	Max. input limit: 2	
Change valid IMMEDIATELY	Protection level: 7/3	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	Basic system 0: Not defined 1: METRIC 2: INCH		

52808	ISO_SIMULTAN_AXES_START		
SD number	Simultaneous drill position approach for all programmed axes		
Default setting: 0	Min. input limit: 0	Max. input limit: 1	
Change valid IMMEDIATELY	Protection level: 7/3	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	Simultaneous drill position approach for all programmed axes 0: OFF 1: ON		

52810	ISO_T_DEEPHOLE_DRILL_MODE		
SD number	Deep-hole drilling with chip breaking/removal of chips		
Default setting: 0	Min. input limit: 0	Max. input limit: 1	
Change valid IMMEDIATELY	Protection level: 7/3	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	Selection of type of deep hole drilling Deep hole drilling with chip breaking Deep hole drilling with removal of chips		

55800	$SCS_ISO_M_DRILLING_AXIS_IS_Z		
SD number	Drilling axis depends on plane / always Z		
Default setting: 0	Min. input limit: 0	Max. input limit: 1	
Change valid IMMEDIATELY	Protection level: 7/6	Unit: -	
Data type: BYTE	Applies as of SW:		
Meaning:	Selection of drilling axis 0: Drilling axis is vertical to active plane 1: Drilling axis is always "Z" regardless of the active plane		

Data fields, lists

8

8.1 Machine data

Number	Identifier	Name
General ($MN_ ...)		
10604	WALIM_GEOAX_CHANGE_MODE	Working area limitation during switchover of geometry axes
10615	NCFRAME_POWERON_MASK	Delete global basic frames after Power On
10652	CONTOUR_DEF_ANGLE_NAME	Adjustable name for angle in the contour short description
10654	RADIUS_NAME	Adjustable name for radius non-modal in the contour short description
10656	CHAMFER_NAME	Adjustable name for chamfer in the contour short description
10704	DRYRUN_MASK	Activation of dry run feedrate
10706	SLASH_MASK	Activation of block skip function
10715	M_NO_FCT_CYCLE[n]: 0, ..., 0	M function number for tool-changing cycle call
10716	M_NO_FCT_CYCLE_NAME[ ]	Name of tool-changing cycle with M functions from MD $MN_MFCT_CYCLE
10717	T_NO_FCT_CYCLE_NAME	Name of tool-changing cycle for T function
10718	M_NO_FCT_CYCLE_PAR	M function replacement with parameters
10719	T_NO_FCT_CYCLE_MODE	Parameter assignment for T function replacement
10760	G53_TOOLCORR	Mode of operation G53, G153 and SUPA
10800	EXTERN_CHAN_SYNC_M_NO_MIN	First M number for channel synchronization
10802	EXTERN_CHAN_SYNC_M_NO_MAX	Last M number for channel synchronization
10804	EXTERN_M_NO_SET_INT	M function for ASUB activation
10806	EXTERN_M_NO_DISABLE_INT	M function for ASUB deactivation
10808	EXTERN_INTERRUPT_BITS_M96	Interrupt program execution (M96)
10810	EXTERN_MEAS_G31_P_SIGNAL	Assignment of the measuring inputs for G31 P..
10812	EXTERN_DOUBLE_TURRET_ON	Double turret head with G68
10814	EXTERN_M_NO_MAC_CYCLE	Macro call via M function
10815	EXTERN_M_NO_MAC_CYCLE_NAME	Subprogram name for M function macro call
10816	EXTERN_G_NO_MAC_CYCLE	Macro call via G function
10817	EXTERN_G_NO_MAC_CYCLE_NAME	Subprogram name for G function macro call
10818	EXTERN_INTERRUPT_NUM_ASUP	Interrupt number for ASUB start (M96)
10820	EXTERN_INTERRUPT_NUM_RETRAC	Interrupt number for rapid retraction (G10.6)
10880	EXTERN_CNC_SYSTEM	External control system, whose programs are to be executed
10881	EXTERN_GCODE_SYSTEM	ISO mode T: G code system
10882	NC_USER_EXTERN_GCODES_TAB[n]: 0-59	List of user-specific G commands of an external NC language
10884	EXTERN_FLOATINGPOINT_PROG	Evaluation of programmed values without decimal point
10886	EXTERN_INCREMENT_SYSTEM	Definition of increment system

Number	Identifier	Name
10888	EXTERN_DIGITS_TOOL_NO	Number of digits for T number in the external language mode
10890	EXTERN_TOOLPROG_MODE	Tool change programming in case of external programming language
18190	MM_NUM_PROTECT_AREA_NCK	Number of files for machine-related protection zones (SRAM)
18800	MM_EXTERN_LANGUAGE	Activation of external NC languages
Channel-specific ($MC_ ...)		
20050	AXCONF_GEOAX_ASSIGN_TAB[ ]	Assignment of geometry axis to channel axis
20060	AXCONF_GEOAX_NAME_TAB[ ]	Geometry axis in channel
20070	AXCONF_MACHAX_USED[ ]	Machine axis number valid in channel
20080	AXCONF_CHANAX_NAME_TAB[ ]	Channel axis name in the channel
20094	SPIND_RIGID_TAPPING_M_NR	M function for switching over to controlled axis mode
20095	EXTERN_RIGID_TAPPING_M_NR	M function number in the external language mode for switching over spindle to controlled spindle mode
20100	DIAMETER_AX_DEF	Geometry axis with transverse axis functionality
20150	GCODE_RESET_VALUES[n]: 0 to max. number of G codes	Reset G groups
20152	GCODE_RESET_MODE	Reset behavior of G group
20154	EXTERN_GCODE_RESET_VALUES[n]: 0-30	Reset G groups
20156	EXTERN_GCODE_RESET_MODE	Reset behavior of external G groups
20380	TOOL_CORR_MODE_G43G44	Handling the tool length compensation G43/G44
20382	TOOL_CORR_MOVE_MODE	Retract the tool length compensation
20732	EXTERN_G0_LINEAR_MODE	Determine interpolation behavior with G00
20734	EXTERN_FUNCTION_MASK	Function mask for external language
22420	FGROUP_DEFAULT_AXES[ ]	Default value for FGROUP command
22512	EXTERN_GCODE_GROUPS_TO_PLC[n]: 0-7	Transmit G command of an external NC language to PLC
22515	GCODE_GROUPS_TO_PLC_MODE	Response of the G group transfer to PLC
22900	STROKE_CHECK_INSIDE	Direction (inside/outside) in which the protection zone is effective
22910	WEIGHTING_FACTOR_FOR_SCALE	Unit of the scaling factor
22914	AXES_SCALE_ENABLE	Activation for axial scaling factor (G51)
22920	EXTERN_FEEDRATE_F1_F9_ACTIV	Permit fixed feedrates with F0 - F9
22930	EXTERN_PARALLEL_GEOAX	Assignment of parallel channel geometry axis
24004	CHBFRAME_POWERON_MASK	Reset channel-specific basic frame after Power On
24006	CHSFRAME_RESET_MASK	Active system frames after reset
28080	NUM_USER_FRAMES	Number of work offsets
28082	MM_SYSTEM_FRAME_MASK	System frames (SRAM)
29210	NUM_PROTECT_AREA_ACTIVE	Activate protection zone
Axis-specific ($MA_ ...)		
34100	REFP_SET_POS[0]	Home position value/with distance-coded system without any significance
35000	SPIND_ASSIGN_TO_MACHAX	Assignment of spindle to machine axis

8.2 Setting data

Number	Identifier	Name
Channel-specific		
42110	DEFAULT_FEED	Default value for path feedrate
42140	DEFAULT_SCALE_FACTOR_P	Default scaling factor for address P
42150	DEFAULT_ROT_FACTOR_R	Default for angle of rotation R
42160	EXTERN_FIXED_FEEDRATE_F1_F9	Fixed feedrates F1 - F9
42162	EXTERN_DOUBLE_TURRET_DIST	Tool distance of double turret head
42520	CORNER_SLOWDOWN_START	Start of feedrate reduction in G62
42522	CORNER_SLOWDOWN_END	End of feedrate reduction in G62
42524	CORNER_SLOWDOWN_OVR	Override for feedrate reduction in G62
42526	CORNER_SLOWDOWN_CRIT	Corner detection in G62, G21
42890	M19_SPOSMODE	Positioning mode of the spindle when programming M19
42940	TOOL_LENGTH_CONST	Change of tool length component for change of plane
42950	TOOL_LENGTH_TYPE	Assignment of the tool length compensation independent of tool type
42990	MAX_BLOCKS_IN_IPOBUFFER	Max. number of blocks in the IPO buffer
42995	CONE_ANGLE	Taper angle
Axis-specific		
43120	DEFAULT_SCALE_FACTOR_AXIS	Default axial scaling factor with active G51
43240	M19_SPOS	Position of spindle when programming M19
43340	EXTERN_REF_POSITION_G30_1	Home position for G30.1

Alarms

9

If error conditions are detected in cycles, an alarm is generated and the execution of the cycle is aborted.

The cycles continue to output messages in the dialog line of the control. These message will not interrupt the program execution.

Alarms with numbers between 61000 and 62999 are generated in the cycles (see /DA/, Diagnostics Manual and /PGZ/, Cycles, Programming Manual). This range of numbers, in turn, is divided again with regard to alarm responses and cancel criteria.

The table below also contains error messages for the cycles described in the chapter "Cycles and contour definition".

Table 9- 1 Alarm no. and alarm description

Alarm no.	Short description	Source	Explanation/remedy
Alarms - in general			
61001	Thread lead incorrectly defined	CYCLE376T	Thread lead incorrectly defined
61003	No feedrate programmed in cycle	CYCLE371T, CYCLE374T, CYCLE383T, CYCLE384T, CYCLE385T, CYCLE381M, CYCLE383M, CYCLE384M, CYCLE387M	No "F" feedrate was programmed in the call block or before the cycle call, refer to Siemens standard cycles
61004	Configuration of geometry axis is not correct	CYCLE328	The sequence of the geometry axes is incorrect, refer to Siemens standard cycles
61101	Reference plane incorrectly defined	CYCLE375T, CYCLE81, CYCLE83, CYCLE84, CYCLE87	Refer to Siemens standard cycles
61102	No spindle direction programmed	CYCLE371T, CYCLE374T, CYCLE383T, CYCLE384T, CYCLE385T, CYCLE381M, CYCLE383M, CYCLE384M, CYCLE387M	Spindle direction M03 or M04 is missing, refer to Siemens standard cycles
61107	First drilling depth incorrectly defined		First drilling depth contradicts total drilling depth
61603	Groove shape incorrectly defined	CYCLE374T	Groove depth is 0
61607	Start time incorrectly defined	CYCLE376T	The start point reached before the cycle call is not outside the range to be processed
61610	No infeed depth programmed	CYCLE374T	Infeed depth is 0.

Alarm no.	Short description	Source	Explanation/remedy
ISO alarms			
61800	External CNC system is missing	CYCLE300, CYCLE328, CYCLE330, CYCLE371T, CYCLE374T, CYCLE376T, CYCLE383T, CYCLE384T, CYCLE385T, CYCLE381M, CYCLE383M, CYCLE384M, CYCLE387M	Machine datum for external language MD18800: $MN_MM_EXTERN_LANGUAGE and/or option bit 19800 $ON_EXTERN_LANGUAGE is not set
61801	Wrong G code selected	CYCLE300, CYCLE371T, CYCLE374T, CYCLE376T, CYCLE383T, CYCLE384T, CYCLE385T	An impermissible numerical value has been programmed in the CYCLE300<value> cycle call, for the CNC system entered, or an incorrect value has been stated for the G code system in the cycle setting datum.
61802	Wrong axis type	CYCLE328, CYCLE330	The programmed axis is assigned to a spindle
61803	Programmed axis does not exist	CYCLE328, CYCLE330	The programmed axis does not exist in the system. Check MD20050-20080
61804	Programmed position exceeds home position	CYCLE328, CYCLE330	The programmed intermediate position or the current position is after the home position.
61805	Value programmed as absolute and incremental	CYCLE328, CYCLE330, CYCLE371T, CYCLE374T, CYCLE376T, CYCLE383T, CYCLE384T, CYCLE385T	The programmed intermediate position is programmed as absolute as well as incremental.
61806	Wrong axis assignment	CYCLE328	The sequence of the axis assignment is wrong
61807	Incorrect spindle direction programmed (active)	CYCLE384M	The programmed spindle direction contradicts the spindle direction provided for the cycle
61808	Final drilling depth or single drilling depth is missing	CYCLE383T, CYCLE384T, CYCLE385T, CYCLE381M, CYCLE383M, CYCLE384M, CYCLE387M	Total depth "Z" or single drilling depth "Q" is missing in the G8x block (first call of cycle)
61809	Drilling position not permissible	CYCLE383T, CYCLE384T, CYCLE385T	
61810	ISO G code not possible	CYCLE383T, CYCLE384T, CYCLE385T	
61811	ISO axis name not permissible	CYCLE328, CYCLE330. CYCLE371T, CYCLE374T, CYCLE376T, CLE383T, CYCLE384T, CYCLE385T	An impermissible ISO axis name has been programmed in the call block
61812	Value(s) in the external cycle call is incorrectly defined	CYCLE371T, CYCLE376T,	An impermissible numerical value has been programmed in the call block

Alarm no.	Short description	Source	Explanation/remedy
61813	GUD value incorrectly defined	CYCLE376T	An impermissible numerical value was entered in the cycle setting data
61814	Polar coordinates not possible	CYCLE381M, CYCLE383M, CYCLE384M, CYCLE387M	
61815	G40 not active	CYCLE374T, CYCLE376T	G40 was not active before the cycle call
61816	Axes not at home position		
61817	Axis coordinates within protection zone		
61818	Axis limit values are the same		

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