

Appendix Cycle Packages for SW 4.7 SP1 HF4

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1. Reference documents

1.1. List of reference documents and editions

- /1/ SINUMERIK 840D sl / 828D
Measuring Cycles – Programming Manual 01/2015 (SW 4.7 SP1)
- /2/ SINUMERIK 840D sl / SINUMERIK Operate (IM9)
Commissioning Manual 01/2015 (SW 4.7 SP1)
- /3/ SINUMERIK 840D sl / 840D / 840Di
Cycles – Programming Manual 01/2008 (SW 1.5 840D sl or SW 7.5 840D)
- /4/ SINUMERIK 840D sl / 828D
Milling – Operating Manual 01/2015 (SW 4.7 SP1)
- /5/ SINUMERIK 840D sl / 828D
Turning – Operating Manual 01/2015 (SW 4.7 SP1)
- /6/ SINUMERIK 840D sl / 828D
Production Planning – Programming Manual 01/2015 (SW 4.7 SP1)
- /7/ SINUMERIK 840D sl / 828D
Grinding – Operating Manual 01/2015 (SW 4.7 SP1)
- /8/ SINUMERIK 840D sl / 828D
Functional Manual Special Functions T4 01/2015 (SW 4.7 SP1)

1.2. Documentation overview – where cycle topics are described

Document	Contents
SINUMERIK 840D sl/828D Milling Operating Manual	In Chapter 3 – All functions for measuring in JOG - workpiece and tools on milling machines Chapter 7 – Generating a G-code program Chapter 8 – Generating a ShopMill program Chapter 9 – Programming cycles (including all drilling, milling and turning cycles)
SINUMERIK 840D sl/828D Turning Operating Manual	In Chapter 3 – Measuring tools in JOG on lathes Chapter 7 – Generating a G-code program Chapter 8 – Generating a ShopTurn program Chapter 9 – Programming cycles (including all drilling, milling and turning cycles)
SINUMERIK 840D sl/828D Measuring Cycles Programming Manual	Chapter 1 – Basics/measuring principle, etc. (as before) Chapter 2 – All measuring versions, workpiece and tool measuring, turning and milling– SK oriented Chapter 3 – Overview parameter list of the measuring cycles (for external programming): contains the call interfaces for all measuring cycles in the G-code and detailed description of the transfer parameters Chapter 4 – Attachments, list for the changeover to SW from 2.7/4.4
SINUMERIK 840D sl/828D	Chapter 19 - Programming cycles externally: contains the call

Programming Manual, Production Planning	interfaces for all technological cycles in the G-code and detailed description of the transfer parameters
SINUMERIK 840D sl SINUMERIK Operate (IM9) Commissioning Manual	Chapter 9 – Settings for simulation and simultaneous recording Chapter 21 – Configuring cycles Contains a description of the machine and setting data for cycles, swiveling, JobShop, adapting manufacturer cycles (CUST_TECHCYC, CUST_MEACYC, etc.)
SINUMERIK 840D sl/828D Grinding Operating Manual	Chapter 8 – Programming technological functions (including all grinding cycles)
SINUMERIK 840D sl/828D Function Manual Special Functions	T4: Automatic reoptimization with AST (including all AST cycles) <i>(only for 840D sl, description for machine manufacturers)</i>

2. Cycle packages– functional scope

2.1. Technology cycles

The functional scope of the technology cycles is described in documents /4/ and /5/.

Difference list cycles/cycle functions for 840D sl SW 1.5 (cycles SW 7.5):

The following cycle/cycle functions are not included in this cycle package:

Cycle	Function and entry softkeys
POCKET1 POCKET2	Square pocket/circular pocket ¹

An assignment list of the earlier adjustable parameters (GUD variable) to the machine and setting data is provided in Attachment_1.

2.2. Measuring cycles

The functional scope of the measuring cycles is described in document/1/.

Difference list measuring cycles/cycle functions for 840D sl SW 1.5 (measuring cycles SW 7.5):

The following cycle/cycle functions are not included in this cycle package:

- Logging of measurement results
- For workpiece measurement with automatic tool correction, the tool to be corrected can still only be specified using the tool name – the alternative by specifying a tool number is no longer possible. Further, it is no longer possible to select a tool environment TENV. This function is an absolute special case and was no longer implemented as from SW 4.4.

2.3. Cycles for ISO compatibility

The setting data for cycles for ISO compatibility (GUD fields_ZSFR, _ZSFI) has been changed over to configured machine and setting data.

An assignment list of the previous adjustable parameters (GUD variable) to the machine and setting data is provided in Attachment_2.

¹ The POCKET1/POCKET2 function is covered by the newer pocket milling cycle POCKET3/POCKET4

3. Compatibility

3.1. Compatibility with other system components

These cycle packages are included in SINUMERIK 840D sl and SINUMERIK 828D SW 4.7 SP1.

3.2. Compatibility to cycle packages 840D sl up to SW 1.5

In the following points, the behavior of the cycles has changed when compared to software releases up to SW 1.5:

Technology cycles:

- o Milling cycles - calculation of the infeed depth with/without taking into account the safety clearance (previously, this was able to be set in the GUD variables `_ZSD[1]`):
In setting data `$SCS_FUNCTION_MASK_MILL_SET` bit 2, you can set whether the safety clearance should be taken into account or not when calculating the depth. Previously, "taking into account the safety clearance" was set as default value – "without taking into account the safety clearance" is now set as default value.
As a consequence, the individual depth infeeds can change in existing programs.
The setting of this setting data acts in G code programs and ShopMill or ShopTurn programs in the same way.
- o Milling cycles when calling with MCALL:
With MCALL, milling cycles in G code programs can also be optionally called on position patterns.
- o Tapping cycles CYCLE84, CYCLE840 – technology parameters (previously, these could be set in GUD variables):
The machine manufacturer must enter his required technology parameter settings in the corresponding setting data. These settings are neither changed by the cycle nor through the input screen form.
- o Tapping cycle CYCLE840 – parameter for direction of rotation reversal:
The "direction of rotation for retraction" parameter is no longer supported in the input screen form of the cycle. This is practical, as in the meantime, the cycle has this function for both thread types, and it also only functions if, before the call, the spindle direction is programmed.
- o Pocket milling cycles POCKET3 and POCKET4 – parameters for plunge feed :
The programmed feed for the depth infeed is only effective for "predrilled" and "vertical". "Helical" and "oscillating" plunging is realized with the feed for machining in the plane.
- o Milling cycle, rectangular pocket POCKET3 – reference, angle of rotation of the pocket:
The angle of rotation now always acts at the reference point. The programming for the rectangular pocket "corner is reference point" and "angle of rotation refers to the center" (with `ZSD[2]=1` and `ZSD[9]=1`) no longer exists, and results in Alarm 61109 "Parameter `_STA` incorrectly defined".
- o Milling cycles – parameters for the infeed width:
A value > 0 must always be entered for the infeed width. The field is marked as being incorrect in the screen form, and the cycle outputs an alarm.
- o Drilling and milling cycles – parameters for the safety clearance:
A value > 0 must always be entered for the safety clearance, as this value is also effective for the switchover from G0 to G1, when approaching to machine in the tool axis. The field is marked as being incorrect in the screen form.
- o High speed settings CYCLE832: The differences are explained using the documentation:
Documentation up to SW 7.5: Cycles – Programming Manual /3/
Documentation from SW2.6 and higher: Commissioning guide IHsl IM9 /2/
Milling Operating Manual /4/ or turning Operating Manual /5/
 - o All of the functions documented in /6/ "Point 3.17", which are coded in parameter `_TOLM` – with the exception of the machining type (`_TOLM` ones position) – are only supported in the compatibility mode from SW release 2.6.
 - o All GUDs described in /6/ Point "3.17.4.3 Adaptation of the machine manufacturer" and the documented functionality are no longer applicable from SW release 2.6.
 - o Note regarding /6/ "Point 3.17.4.4 adaptation of additional program parameters `CYC_832T`"
From software release 2.6, user cycle `CYC_832T.SPF` will be replaced by cycle `CUST_832.SPF`. To secure compatibility, markers `_M0` to `_M4` are still available in cycle `CUST_832`. Transfer parameter `_OVL_on` of `CYC_832T` has been omitted, as the documented machine data in CYCLE832 will not be rewritten.
 - o Note regarding /6/ Point "3.17.5 Interfaces"

All documented machine and setting data will not be rewritten in CYCLE832 from SW release 2.6. All documented channel-specific variables GUD7 are omitted from SW release 2.6.

- o When using CYCLE832, the option Advanced Surface (AS) must always be active.

Otherwise fault 8025 "Option AS not set" is output.

According to the application example AS in the commissioning regulation HMI Operate (03/2010), AS requires certain G commands. These G commands are not necessarily compatible to the settings of the "old" CYCLE832 or CYC_832T. These new G commands are entered as recommendation (commented out with a ;) in the individual markers of the compatibility arm (from marker _M1).

The SOFT command is always activated, as BRISK is not applicable with AS.

The old CYCLE832 calls should only be used in exceptional cases. When upgrading the machine, preferably the old calls should be replaced with the new calls with CYCLE832. The tolerance and machining type (roughing, finishing, ..) settings can be taken over.

The _FACTOR parameter should no longer be used.

For factor settings, refer to the commissioning regulation HMI Operate (03/2010) -> SD55441 to SD55443.

If parameter _FACTOR in CUST_832.SPF is written to in the compatibility arm, then this value is active.

- o Swivel cycle CYCLE800: (reference to the documents as in Point 8. for CYCLE832):

- o The menu screens documented in /6/ under Point "3.16.7.2 commissioning kinematic chain" used to commission swivel are no longer available in SW release 2.6. The parameters (vectors) of the kinematic chain can be read and written as NC variables -> see /5/ CYCLE800.

Example: \$TC_CARR1[2]=123.456 -> linear vector l1X of the 2nd swivel data set = 123.456

- o The coding of parameter \$TC_CARR37[swivel data set n] has changed:

The setting "direction rotary axis 1" or "direction rotary axis 2" at the 4th position (THOUSANDS) \$TC_CARR37[n], is no longer permitted from release SW 2.6 SP1 and must be replaced by the setting "direction rotary axis 1 optimized" or "direction rotary axis 2 optimized". This therefore supports the pole position of a rotary axis with both selection options of the direction (plus or minus).

The following definition applies for the coding of parameter _MODE and _DIR in the call interface of the CYCLE800:

If an "old" program call is taken over, then the setting direction optimized is taken over in the HUNDRED THOUSANDS position of parameter _MODE:

_DIR = -1 _MODE = 10xxxx swivel yes, direction minus

_DIR = +1 _MODE = 20xxxx swivel yes, direction plus

_DIR = 0 _MODE = 11xxxx swivel no, direction minus

_DIR = 0 _MODE = 22xxxx swivel no, direction plus

If the setting direction in \$TC_CARR37[n] is changed when upgrading to SW release 2.6, then the corresponding NC programs must be run in again.

This is especially true for programs where a rotary axis is in the pole position when swiveling, e.g. swivel table, rotary axis A=0 (pole position) swivel with rotary axis C.

- o The coding, retraction in the 7th and 8th position of \$TC_CARR37[n] x00xxxxxx up to x03xxxxxx is newly coded from SW release 2.6.

	up to SW2.6	from SW2.6
\$TC_CARR37[n]	x00xxxxxx	x01xxxxxx retract Z
\$TC_CARR37[n]	x01xxxxxx	x03xxxxxx retract Z or Z, XY
\$TC_CARR37[n]	x02xxxxxx	x02xxxxxx retract Z, XY
\$TC_CARR37[n]	x03xxxxxx	x00xxxxxx no retract

- o From SW release 2.6, the swivel data sets must be designated as either being active or not active. This is realized in parameter \$TC_CARR37[n] at the 9th position (HUNDREDMILLION).

\$TC_CARR37[n] 0xxxxxxx to 3xxxxxxx means that the swivel data set is not active

\$TC_CARR37[n] 4xxxxxxx to 7xxxxxxx means that the swivel data set is active

Parameters \$TC_CARR38[n] up to \$TC_CARR40[n] are converted from the NCK from SW release 75 into the actual dimension system (either inch or metric). If the parameters are written to in customers' user cycles, then it is mandatory that this is taken into account when upgrading to SW release 2.6 in conjunction with NCK from 75 and higher.

NC programs with the data of the swivel data set can be reused with SW release 2.6 if parameter \$TC_CARR37[n] is appropriately adapted.

- o Note regarding /6/ Point "3.16.8 manufacturer cycle TOOLCARR.SPF"

User cycle TOOLCARR.SPF will, from SW release 2.6, be replaced by cycle CUST_800.SPF. From a functional perspective, cycle CUST_800.SPF corresponds to cycle TOOLCARR.SPF, including all of the markers provided for the machine manufacturer for corresponding machine-specific adaptations - > refer to the comments in the CUST_800.

If the "track tool" function is activated, then in cycle CUST_800.SPF, the 1st multi-axis transformation (TRAORI(1)) is active for tool tracking.

From SW release 2.6, there is a new feature with marker _M35 in CUST_800.SPF to support semi-automatic and manual rotary axes in the block search. From a content perspective, marker _M35 replaces cycle CYCPE_SC.SPF, which from SW release 2.6 is omitted.

- o If the optimized behavior in the initial position (pole position) of the rotary axes is not required (for compatibility reasons), then it can be deactivated using the following setting data:
SD 55221 \$SCS_FUNCTION_MASK_SWIVEL_SET Bit 4
Bit 4 = 0, evaluation of the CYCLE800 input values in the pole position of the machine kinematics
Bit 4 = 1 CYCLE800: Compatibility
- o Circular pocket cycle POCKET4 – plunging: for a depth infeed with G0 (predrilled), G0 is now always applied as depth infeed, independent as to whether a raw dimension is programmed or not. It is assumed that space is available up to (DP+SDIS)
For infeed into the material, the programmed helix radius is active, if this is lower than the tool radius. Previously, the tool radius applied in this case.
- o Pocket milling cycles POCKET3, POCKET4 – special case 1 depth infeed: For roughing/finishing, only 1 depth infeed is executed, if the infeed depth >= max. material depth where stock must be removed.

These changes mean that existing programs must be adapted.

Measuring cycles:

1. With the introduction of new machine and setting data cycles, the data concept of the measuring cycles has been revised. Setting data, which was previously saved in GUD variables, have now become machine and setting data.
Document /4/ includes in Appendix A, tables with the corresponding information:
 - o Comparison of GUD parameters ⇔ machine and setting data
 - o GUD variables that can no longer be used
 - o Changes to the names of cycles and GUD blocks.
2. When using measuring cycles with different system of units (base system <> programmed system) and when programming G commands G70 or G71, the dimension unit of the following tolerance parameters has changed – they now refer to the programmed system (previously, the base system):
Confidence range (_TSA), zero correction range (_TZL), average value generation with correction (_TMV), dimension difference check (_TDIF).
3. When using the measurement cycles with different measurement systems (basic system <> programmed system) and programming the G commands G70, 700, the measurement unit for the measurement path (_FA) has changed. Up to now, this has always been given in millimeters (mm). The measurement unit for the measurement path now always refers to the programmed system.

These changes mean that existing programs with measuring cycles must be correspondingly adapted.

ShopMill cycles:

1. Up to SW 1.5, it was also possible to incrementally specify the reference point (X0, Y0, Z0) for ShopMill. In newly opened screen forms, the reference point can now only be entered in absolute terms.
For recompiled screen forms, in which an incremental reference point occurs, then an abs/inc toggle field is displayed. For inc, the check sets an error message "Reference point inc no longer supported, please convert to abs".

3.3. Compatibility with grinding programs with 802D sl

802Dsl grinding programs are not executable without making the relevant adjustments. This is due to the new tool concept (grinding wheels and dresser).

3.4. Adapting machine manufacturer cycles

Notice:

Generally, the machine manufacturer is recommended to copy all CUST cycles with changed functionality with respect to the initial state before the upgrade and then readapt them.

If an upgrade is only made to resolve errors (debugs) and no new functions are to be used from this software release, then the compatibility can be established as described in the following.

3.4.1. Status CUST cycles in SW 4.6

The table provides an overview of the changes in the machine manufacturer cycles from software 2.7/4.4 (this also applies to the following SPx and HFx releases).

Cycle	Function, significance	Adaptations after the upgrade
CUST_TECHCYC	Manufacture cycle to adapt the functions of the technological cycles	includes new functions when compared to SW 4.5
CUST_800	Manufacturer cycle for adaptation to the function swivel plane and swivel tool (CYCLE800)	includes new functions when compared to SW 4.5
CUST_832	Manufacturer cycle for the adaptation of the High speed settings function (CYCLE832)	No change with respect to SW 2.7/4.4 and SW 4.5
CUST_MEACYC	Manufacturer cycle to adapt functions for measuring cycles	includes new functions when compared to SW 4.5
CUST_T	Cycle is used to track T -preparation after SERUPRO	From SW 4.5, bit 1 in MD 20310 \$MC_TOOL_MANAGEMENT_MASK must be set
CUST_M6	Cycle is used to track the tool change after SERUPRO	No change with respect to SW 2.7/4.4 and SW 4.5
CUST_MULTICHAN	Manufacturer cycle for lathes with several channels	No change with respect to all previous releases
CUST_CLAMP	Manufacturer's cycle for clamping elements	No change with respect to all previous releases

3.4.2. Special notes regarding the upgrade

When upgrading from a previous release SW 2.6 or SW 2.6 SP1, all of the CUST cycles from SW 4.6 must be taken and adapted, which had already been modified before the upgrade.

When upgrading from previous releases

SW 2.7/4.4 SPx HFx or

SW 4.5 up to and including SW 4.5 SP1 HFx

the compatibility can be established as described above.

When upgrading from SW 4.5 SP2, adaptation is not required.

To use the new functions from SW 4.6, the cycles must be copied and appropriately adapted by the machine manufacturer (OEM).

3.4.3. Establishing compatibility

The machine manufacturer cycles CUST_<Name> have been functionally extended so that after a software upgrade, existing CUST cycles from SW 2.7/4.4 are still able to run after a small one-off (single) adaptation (compatibility). The adaptation means that when calling new functions (new transfer values in the MODE parameter), a branch is always made to the actual CUST cycle in the standard cycle directory, which belongs to the cycle package.

Adapting means the following:

- Copying blocks from the CUST cycle, supplied in the CST.DIR and inserting in the existing cycle in the CMA.DIR
- **This procedure is just once**, if the cycle had a previous version < 4.5 SP2;
- All of the blocks to be copied are bracketed with
;BEGIN_DO_UPGRADE
;END_DO_UPGRADE

CUST_TECHCYC – copy 2 blocks:

- (1) Copy the first designated block, and insert immediately before the instruction

CASE _MODE OF 1 GOTOF _M1 2 GOTOF _M2 ...

Insert

- (2) Copy the second designated block, and use it to replace
SETAL(61019,"_MODE="<<_MODE) ; Parameter _MODE=n ...
Replacing

CUST_800 – copy 2 blocks:

- (1) Copy the first designated block and insert directly before the 1st executable instruction
IF (_MODE>=21)AND(_MODE<=31)) ...
Insert
- (2) Copy the second designated block, and use it to replace
SETAL(61019,"_MODE="<<_MODE) ; Parameter _MODE=n ...
Replacing

CUST_MEACYC – copy 4 blocks:

- (1) Copy the first designated block, and insert immediately before the instruction
IF _MODE==2 GOTOF _MEACYC_END ...
Insert
 - (2) Using the three additional blocks, the blocks for alarm outputs are replaced.
...
N631001 SETAL(61099," Parameter _OVI[2] ")
...
N631002 SETAL(61099," Parameter _OVI[2] ")
...
N631003 SETAL(61099," Parameter _OVI[14] ")
...
Copy the designated block and use it to replace the instruction
N631xxx SETAL(61019,...
Replacing
-

4. Changes with respect to the previous release

4.1. Changes from software version 4.6

This section only describes the changes regarding Software Release 4.5

New functions, functional changes / expansions, technology cycles:

1. New cycles:

DRILLING:

- New CYCLE830 deep drilling cycle

SWIVELING:

- New CYCLE807 cycle for retraction when turning on milling machines and retraction in the tool direction with B axis in rotary operation.

2. Expansion of existing cycles:

DRILLING:

- CYCLE82 expanded to include pre-drilling/through-drilling
- Expansion of hole-circle (HOLES2) and arbitrary positions (CYCLE802) to include rotary axes in position pattern in G-code too, position pattern also on front surface (rotary axis rotates around 3rd geometry axis), adaptations to TRANSMIT/TRACYL

TURNING:

- Expansion of thread cutting (CYCLE99 only) to include support for convex threads
- Expansion of stock removal along contour (CYCLE952) for complete machining

SWIVELING:

- Expansion of CYCLE800 (lathe basic position B-axis parallel to X)

3. Modified behavior in existing cycles:

- all cycles: query of simulation status is no longer made through access to \$P_SIM, but via access to the new MD 18965 \$MN_SIM_ENVIRONMENT
- Expansion of CUST_TECHCYC
CUST_TECHCYC(170): Start block with spindle
CUST_TECHCYC(171): End block with spindle
- Behavior when scaling in the pocket milling cycles POCKET3 and POCKET4 changed:
 - o Geometry data (also retraction plane and rough sizes) are scaled
 - o Technology values (depending on tool) are not scaled (infeed depth, feed plane, helix radius, helix angle, safety distance, measurements, approach/retraction radius)
 - o Conditions: scaling factors do not differ in plane, scaling in depth may vary. When chamfering, the scaling factors in all 3 geometry axes must be the same as chamfer depends on tool (chamfer angle must be maintained).
- CYCLE86 – modified correction algorithm for the spindle position in swiveled or turned WCS; to be connected with new SD bit because of compatibility
- CYCLE86 – When mirroring is active, the direction when retracting in the plane is adapted in the cycle to the active mirroring; to be activated with new SD bit because of compatibility

New functions, functional changes / expansions, measurement cycles:

- Turning on milling machine: Expansions for tool measurement on milling machine with turning
 - o **Measurement of turning tools possible on milling machine**
- Consistency of "measuring with rotation"
- Spindle orientation of the probe in the measuring direction
- Measurement without SPOS-compatible spindle

Functional changes/expansions configurable machine and setting data:

- New machine and setting data:

MD 52001 \$MCS_DISP_COORDINATE_SYSTEM_2
Coordinate system for turning and milling machines

MD 52242 \$MCS_TURN_TOOL_FIXING
Tool adapter for turning tools
0 = turning tools in the tool spindle
1 = turning tools fixed at the tool spindle box
2 = turning tools in the tool spindle or fixed at the tool spindle box

New setting data for the "technology scaling in the cycle masks" function

SD 55300 \$SCS_EASY_SAFETY_CLEARANCE	Safety clearance
SD 55301 \$SCS_EASY_DWELL_TIME	Dwell time
SD 55305 \$SCS_EASY_DRILL_DEEP_FD1	Percentage 1. feed, deep hole drilling
SD 55306 \$SCS_EASY_DRILL_DEEP_DF	Percentage infeed, deep hole drilling
SD 55307 \$SCS_EASY_DRILL_DEEP_V1	Min. depth infeed, deep hole drilling
SD 55308 \$SCS_EASY_DRILL_DEEP_V2	Retract amount, deep hole drilling
SD 55309 \$SCS_EASY_THREAD_RETURN_DIST	Return distance, thread turning

- Expanded functions in the existing machine and setting data:

MD 51740 \$MNS_MEA_FUNCTION_MASK
Bit 3: no longer applicable, the function is now always active (previously: workpiece measurement – correction angle for mono probe)

MD 52207[x] \$MCS_AXIS_USAGE_ATTRIB
Bit 8: list rotary axis for accepting blank (at milling machines)

MD 52210 \$MCS_FUNCTION_MASK_DISP
bit 9: Display select "Simple input"
Bit 10: Do not list channel in the job lists (for mixed programs in the job lists)
Bit 11: For WCS, activate the display of the logical spindles
The display of logical spindles in WCS is only effective if the following conditions are fulfilled:
1. The spindle converter is activated (MD 20092 \$MC_SPIND_ASSIGN_TAB_ENABLE).
2. Every physical spindle is precisely assigned a logical spindle via the channel setting data table 42800[] \$SC_SPIND_ASSIGN_TAB.
If the conditions are not fulfilled, then the physical spindles are displayed in the WCS.

The physical spindles are always displayed in the MCS

MD 52212 \$MCS_FUNCTION_MASK_TECH
Bit 10: Aligning the turning tool via kinematic transformation

MD 52214 \$MCS_FUNCTION_MASK_MILL
Bit 1: List table to accept blank (on milling machines)

MD 52218 \$MCS_FUNCTION_MASK_TURN:
Bit 8: Enter the spindle chuck data in the program
Bit 9: Additional input of the tailstock data in the program

MD 52740 \$MCS_MEA_FUNCTION_MASK:
Bit 13: is no longer applicable (previously: Measure kinematics – scaling of the orientation vectors)

SD 54740 \$SNS_MEA_FUNCTION_MASK:
Bit 18: is no longer applicable (previously: Tool measurement – stop with M0 when exceeded _TDIF)

SD 55216 \$SCS_FUNCTION_MASK_DRILL_SET:

Bit 6: Adapt the spindle position to the tool orientation (CYCLE86)
Bit 7: Adapt the direction of retraction travel in the plane to the active mirroring (CYCLE86)

Limit values for feedrate input increased:

SD 55200 \$SCS_MAX_INP_FEED_PER_REV from 5 to 15

SD 55202 \$SCS_MAX_INP_FEED_PER_TOOTH from 2 to 5

SD 55221 \$SCS_FUNCTION_MASK_SWIVEL_SET

Bit 5: Align tool (turning technology) using frame calculation (TCOFRY) or absolute (TCOABS)

SD 55410 \$SCS_MILL_SWIVEL_ALARM_MASK

Bit 2: Display alarm 61148: Swiveling of plane with active turning tool not possible

New functions, functional changes / expansions, technology cycles:

1. New cycles:

- New CYCLE226 for tool change in JOG mode for milling and turning when turning on milling machines

Functional changes/expansions configurable machine and setting data:

- Expanded functions, changes in the existing machine and setting data:

MD 52218 \$MCS_FUNCTION_MASK_TURN

Bit 13: Cutting along the contour with CYCLE95 (828D programGUIDE without Advanced Technology)

SD 55581 \$SCS_TURN_CONT_RELEASE_DIST

Minimum value changed from 0 to 0.01

Functional changes/expansions configurable machine and setting data:

- Expanded functions, changes in the existing machine and setting data:

SD 55220 \$SCS_FUNCTION_MASK_MILL_TOL_SET

Protection level for 828D now "System"

Functional changes / expansions, technology cycles:

- Monitoring the tool for groove and cut-off:
In the cycles CYCLE930, CYCLE93 and CYCLE92 all turning tool types are permitted 5xx. If the tool is not a plunging tool (types 520 and 530), then the plate width is calculated from the length difference between two D numbers.

4.2. Changes from software version 4.6 SP1

Functional changes / expansions, ShopMill/ShopTurn:

- ShopTurn - function change in the counterspindle step:
If the machining side is changed in the counterspindle step, then beforehand, the tool is traversed to the tool change point with the retraction levels of the old machining side.

Functional changes / expansions, technology cycles:

- Contour pocket with islands: The number of island contours has been increased from 10 to 20

Functional changes / expansions, ShopMill/ShopTurn:

- Turning on SM milling machines: Changes in the CUST_800
 - o Marker 40: ;TRAFOOF, CUTMODK="" again omitted
 - o Marker 40: ;N800402 G17 omitted, as ineffective due to quasi-modal behavior of CYCLE800
 - o Marker 70: DIAM90 in place of DIAMON
 - o before turning, if required deselect active tool carrier

Functional changes / expansions, ShopMill/ShopTurn:

- Constant cutting speed referred to the diameter of the centering
The function is effective in JobShop – and can be activated using the new MD bit as follows:
SD 52216 \$SCS_FUNCTION_MASK_DRILL bit 3 = 1

Functional changes / expansions, measuring cycles:

- Change relating to the ball measuring cycle (CYCLE997) in conjunction with determining the diameter of the ball to be measured:
In conjunction with the setting "no diameter determination" (i.e. no additional measurement for the diameter), when repeating the measurement, the sphere diameter is calculated from probing for determining the center point.

Functional changes / expansions, measuring cycles:

- Change to the ball measuring cycle (CYCLE997):
 1. When selecting the measurement "with diameter determination", the ball diameter is only determined by performing a separate measurement at the circumference of the ball in the first measurement run.
In the second measurement run (if "repeat measurement" is active", the diameter is always calculated in the cycle, even if diameter determination is not selected.
 2. For ball measurement in parallel to the axis (paraxial), a starting angle (S_STA1) can now be entered.
Then, this functions as in Cycle977 via CYCFRAME.
 3. When measuring the ball by circling, or in parallel to the axis, the separate outside measurement for determining the diameter (in the 1st measurement run) is now also executed in the angular alignment corresponding to the starting angle.
 4. For measuring the ball parallel to the axis (paraxial), the "align probe in the measurement direction" function is now available just the same as for the circling/orbiting version.

4.3. Changes from software version 4.7

Functional changes/expansions configurable machine and setting data:

- Expanded functions in the existing machine and setting data:

MD 52207 \$MCS_AXIS_USAGE_ATTRIB
 Bit 10: Rotary axis rotates around 1st geometry axis (only for position pattern)
 Bit 11: Rotary axis rotates around 2nd geometry axis (only for position pattern)
 Bit 12: Rotary axis rotates around 3rd geometry axis (only for position pattern)
 If one of these 3 bits is set, bits 10 - 12 replace bits 0 - 2 for the evaluation in position patterns.

MD 52216 \$MCS_FUNCTION_MASK_DRILL
 Bit 3: Constant cutting speed relating to the diameter of the centering (ShopMill/ShopTurn)

Functional changes/expansions configurable machine and setting data:

- New machine and setting data:

SD 55730 \$SCS_MEA_PROTOCOL_USER_EXT
Set file type (extension) for user protocols
Default: "TXT"

SD 55774 \$SCS_J_MEA_PROTOCOL_FILE
Establish path and file name for logging in JOG

- Expanded functions in the existing machine and setting data:

SD 55740 \$SCS_MEA_FUNCTION_MASK
Bit 28: Select new log or continuous log for measuring standard log in JOG

Functional changes/expansions configurable machine and setting data:

- Expanded functions in the existing machine and setting data:

SD 52210 \$MCS_FUNCTION_MASK_DISP
Bit 12: Hide mold making view for G code

SD 52211 \$MCS_FUNCTION_MASK_DISP_ZOA
Bit 21: Show BKS position

Functional changes/expansions configurable machine and setting data:

- New machine and setting data:

SD 55422 \$SCS_MILL_SWIVEL_RESET_MODE
Swivel basic position: Swivel mode

This setting information can be used to set the status of the "Swivel Mode" toggle switch on the "Swivel Plane" screen when the "Basic Position" softkey is pressed:

- 0 = by axis (default)
- 1 = solid angle
- 2 = projection angle
- 3 = direct

4.4. Changes from software version 4.7 HF1

New functions, functional changes / expansions, technology cycles:

- CUST_800 new entry points for turning on milling machine:
Retract new markers _M47, _M48 before alignment of tool with transformer on basis of kinematic chain
_M47 = Retract axis Z to MCS fixed position before tool alignment
_M48 = Retract axis Z and then the XY axes to MCS fixed position before tool alignment

New functions, functional changes / expansions, measurement cycles:

- Modified adjustment behavior in NPV when no fine adjustment present:
 - o Compatibility: only the measurement difference is entered into the rough adjustment of the NPV (MD 51740 \$MNS_MEA_FUNCTION_MASK Bit 5 = 0)
 - o New behavior: the absolute displacement corrected by the measured difference is entered into the rough adjustment of the NPV
Activation by means of:
(MD 51740 \$MNS_MEA_FUNCTION_MASK Bit 5 = 1)

New functions, functional changes / expansions, technology cycles:

- CYCLE952 – Multi-channel cutting:

If, in a multi-channel machine, the remaining machining is to take place in a different channel to the preliminary machining, the full name including _Cxx (xx stands for the channel number) must be specified when accessing the cycle in the _CON parameter (read updated raw part contour).

Functional changes/expansions configurable machine and setting data:

- Changes in the existing machine and setting data:

SD 55422 \$SCS_MILL_SWIVEL_RESET_MODE

Only the following statuses still exist:

0 = by axis

1 = direct

New functions, functional changes / expansions, technology cycles:

- Change to CYCLE210: MD 18864 \$MN_MM_NUM_TRAFO_DATA_SETS removed, as omitted in the NC -> replaced by MD 18866 \$MN_MM_NUM_KIN_TRAFOS
- Change to CYCLE800 – swiveling directly with "Rotary axis-NPV <> 0":
The correction to translation of a rotary axis has been changed in such a way that that correction only takes place during movement of the rotary axis in CUST_800. As a result, the MCS and WCS is displayed correctly before/after swiveling The new function is activated in SD 55221 Bit8=1. (SD 55221 Bit8=0 compatibility).
- Change to CYCLE800 – retraction in Z or Z, XY:
Retraction Z or Z,XY takes place with active cutter taking account of the active longitudinal components of the tool. Preferably,
MD 10760 \$MN_G53_TOOLCORR Bit 0=1 and Bit 1=0 should be set.
With swivel heads and mixed kinematics set MD20360 Bit10=1.

Functional changes/expansions, measuring cycles:

- Note on CYCLE961 with mono probe:
When measuring with mono probe, the probe is always positioned vertically to the measuring edge, so no safety angle has to be set. If a safety angle >0 is set, it is ignored. The measurement paths for real and simulated machine and measurement with multi or mono probe must be the same, however.

New functions, functional changes / expansions, technology cycles:

- Functional changes in the swivel cycle (CYCLE800) direct swiveling:
If values are entered in the zero offsets of the rotary axes of the swivel data set, a new positioning behavior results with selected machine kinematics (e.g. mixed kinematics with B/A kinematics) and with direct swiveling.
The new function is activated in SD 55221 \$SCS_FUNCTION_MASK_SWIVEL_SET Bit8=1. (SD 55221 Bit8=0 compatibility).

Functional changes/expansions, measuring cycles:

- Functional change to measuring cycles in respect of feedrate override <> 100%
Measuring blocks are traversed with 100% measurement feedrate irrespective of the feedrate override. This applies to the workpiece and tool measurement. All other positioning blocks in the measurement cycles take place with the current feedrate override.
The function is activated/deactivated with MD 51740 \$MNS_MEA_FUNCTION_MASK Bit 6.
Bit 6=0 measuring blocks (MEAS) are traversed in the measurement cycles with the current feedrate override (compatibility)
Bit 6=1 measuring blocks (MEAS) are traversed in the measuring cycles with 100% feedrate override if the feedrate override is set > 0.

New functions, functional changes / expansions, technology cycles:

- Exit in CUST_TECHCYC(117) before tool change (T-command):
Before the T-command, the following information is available:
_F_T_STR = tool name ("" = no, "0" = T0)
_F_DP_NO = sister tool (-1 = no)
_F_T_MP = magazine location (-1 = no)
_F_T_MP = multi-tool location (-1 = no)
This information can only be used in CUST_TECHCYC(117).

4.5. Changes from software version 4.7 SP1

This chapter only describes the changes with regard to the Software Version 4.7 HF2.

Functional changes / expansions Adapting Cycles:

- New cycles for AST functionality:
 - o CYCLE758 - AST Command: set_parameter_value
 - o CYCLE759 - AST Command: set_parameter_value get_parameter_value

Functional changes / expansions Configurable machine and setting data:

- New machine and setting data:
 - SD 55834 \$SCS_AST_MMC_NEWCONF_HANDSHAKE
 - SD 55835 \$SCS_AST_MMCA
- This are used to ensure the AST functionality.

Functional changes / expansions Cycles ISO compatibility:

- Functional change when tapping with G84 in ISO mode:
After tapping, the spindle can now either remain in position control mode, or you can reactivate the spindle mode. You can make your selection via the new setting data:
 - SD 55807 \$SCS_ISO_M_TAPPING_SET_MC
 - 0 = With G84 Reactivate spindle mode
 - 1 = With G84 Remain in position-controlled mode

Functional changes / expansions Technological cycles:

- Swivel plane: Table positioning direction can be selected (AXA)
- Turning on milling machine: Only replace turning tools without alingment
- Block icon can be specified

Functional changes / expansions Configurable machine and setting data:

- New machine and setting data:
 - SD 54480 \$SNS_AST_MMC_HANDLER_NAME
 - SD 54481 \$SNS_AST_MMC_DEFAULT_IS_PCU
- These are required to ensure the AST functionality.
- Changes in existing machine and setting data:
 - MD 52201 \$MCS_TECHNOLOGY_EXTENSION
 - Values: 3 – Rotary grinding and
 - 4 – flat grinding
 - removed.
- SD 55221 \$SCS_FUNCTION_MASK_SWIVEL_SET
- Bit 9 Swivel data block TC permanently allocated to the tool (with rotary grinding only)

Functional changes / expansions Configurable machine and setting data:

- New machine and setting data:
 - SD 55631 \$SCS_MEA_FEED_MEASURE_DEG
 - SD 55637 \$SCS_MEA_FEED_POS_DEG
 - SD 55648 \$SCS_MEA_KIN_MIN_ANG_POS
- This are required for measuring in combination with rotary axes.
- MD 52211 \$MCS_FUNCTION_MASK_DISP_ZOA
- Bit 23: Display TOFF
- Bit 24: Display overlay \$AA_TOFF

Functional changes / expansions Technological cycles:

- All CUST cycles in the standard cycle directory are protected by the SIEMENS password and can no longer be modified in this directory. Before you can change them, you must copy these cycles into the manufacturer or user cycle directory.

Functional changes / expansions Measuring cycles:

New measuring cycle CYCLE9960 for the kinematics completely measured

Major functions of this new cycles:

- o The measurement of the kinematics is completely supported with a call of CYCLE9960. The user enters the rotary axis range to be measured via a number of measurement points or each rotary axis. The cycle takes over the positioning for measuring the rotary axis.
- o There are four selection options: Kinematic measurement, reference head measurement, adjustment of the head to the reference head, and calculate interpolation points (the function Interpolation points requires the subordinate compile cycle E996).
- o The cycle supports the measurement of kinematics which are defined via the new function "Kinematic chains".
- o The measurement and calculation results can be recorded.

Functional changes / expansions Technological cycles:

- New cycles introduced for CAM operations: CAM_OP_BEGIN and CAM_OP_END

Functional changes / expansions Measuring cycles:

- Function expansion ball measuring cycle (CYCLE997) with monoprobe:
So far, generally only 3D probes, that means tool type 710, were allowed for measuring at a ball. Now, you can also use a monoprobe, that means tool type 712. If the active tool is a monoprobe, you need not change the existing parameters when measuring the ball. If you wish to make measurements on oblique planes, you must position the system before using the swivel cycle (CYCLE800), rather than TRAORI.

Functional changes / expansions Configurable machine and setting data:

- Changes in existing machine and setting data:
SD 55221 \$SCS_FUNCTION_MASK_SVIVEL_SET
Bit 10: Swivel plane: Display input field "Positioning direction"

Functional changes / expansions Grinding cycles:

- Grinding:
The cycle package now also includes cycles for the technologies rotary and flat grinding. These technologies can only be applied if one of them has been set as first technology and no second technology has been set.
Short description s. Chap. **Fehler! Verweisquelle konnte nicht gefunden werden.** **Fehler!**
Verweisquelle konnte nicht gefunden werden.

Functional changes Advanced Contour Cycle:

- Due to the introduction of the grinding cycles in the cycle package, the three following compile cycles are now available instead of the only compile cycle "machgen.elf":
 - o **machgen_manager.elf** – for organizational functions
 - o **machgen_contour_machining.elf** – for Turning/Milling – includes the contents of the existing compile cycle machgen.elf
 - o **machgen_grind_shaping.elf** – for grinding (is called up by the CYCLE495 Profiling)
 No specific commissioning is required.
These compile cycles have one common version, which is still displayed under "Advanced_Contour_Cycle".

Functional changes / expansions Configurable machine and setting data:

- Changes in existing machine and setting data:
MD 52210 \$MCS_FUNCTION_MASK_DISP:
Bit 13: Hide channel axes which are currently located in another channel
0: Display channel axes, which are currently located in another channel, in gray
1: Hide channel axes which are currently located in another channel

Functional changes / expansions Measuring cycles:

- Expand CYCLE996:
Major functions of this new cycle:

- o Correction of the measuring difference by the measuring difference of the tool axis in the basic kinematics position
- o Correction of the ball center by the measuring difference of the tool axis in the basic kinematics position (CYCLE9960)
- o Measure reference head: Correction of the active ZO after measuring in the basic position

Functional changes / expansions Technological cycles:

- Change in CUST_800 – manufacturer cycle for the swivel cycle (CYCLE800):
If no path has to be traversed during tool retraction, the CUST_800 with the markers _M440 and _M450 is also called. The markers _M440 and _M450 are just passed through. The user can supplement his syntax accordingly.

Functional changes / expansions Grinding cycles:

- Change to paraxial profiling:
The option "Grinding Advanced" is required for paraxial profiling.

Functional changes / expansions Technological cycles:

- Change of the drilling cycles when selecting "shaft" with regard to the handling of tool types:
For the tool types without displayed tip angle (types 205, 210, 231, 240-242, 250) in the tool table, no tip angle is evaluated when selecting "shaft" in the cycle (same behavior as tip). A rotary drill type 560 is admitted for "tip".
- Change of the turning cycles (CYCLE92, CYCLE930, CYCLE952, CYCLE93) with grooving tools in the G code:
 - o If, with the active cutting edge, the parameter for the plate width is ≤ 0 , this plate width applies internally. Only the active D number is considered internally.
 - o If, with the active cutting edge, the parameter for the plate width is 0, the plate width is determined from the length difference of two D numbers. If the parameter for the D number of the second cutting edge _DN is programmed, this is valid for the second cutting edge. If this parameter is not programmed, the active D and D+1 are considered. However, the parameter _DN for the second cutting edge cannot be supplied from the cycle input screen. It is documented in /6/.

Functional changes / expansions ShopMill:

- Retraction logics turning on milling machine expanded; at the end of the ShopMill turning cycles, retraction is performed with regard to ZRA.

Functional changes / expansions Grinding cycles:

- Change of the MD preassignment for 828D:
MD 52211 Bit 22 = 1 only for 828D grinding systems

4.6. Changes from software version 4.7 SP1 HF1

Functional changes / expansions Configurable machine and setting data

- New machine and setting data:
MD 52004 \$MCS_PROG_COORDINATE_SYS_CHAN
With this MD you can set that the coordinate system is displayed as described in the channel stated during programming.
0: Display as described in the own channel
n: Display as described in channel n

4.7. Supplementary conditions

- A machine-specific release is required for the application of the new CYCLE9960.
- No measurement result screen is available for the CYCLE9960 (the results, however, can be recorded).
- When upgrading the system from SW 4.5 SPx, the calibration status of probes gets lost. The probes must be recalibrated.

5. Notes on using this cycle package

5.1. Notes on executing the measuring cycles in simulation

The following MD/SD settings apply:

MD 13230 \$MN_MEAS_PROBE_SOURCE

= 0 MEAS simulation without synchronized actions

= 1 to 8 number of the output for synchronized action

MD 10360 \$MN_FASTIO_DIG_NUM_OUTPUTS >= 1 (number of outputs), if MD13230 > 0

SD 55618 \$SCS_MEA_SIM_ENABLE

= 0 no simulation of the measuring cycles. Measuring cycles are not run through

= 1 simulation of measuring cycles

= 9 reserved for automatic testing of measuring cycles (test cases with external synchronized actions)

SD 55619 \$SCS_MEA_SIM_MEASURE_DIFF: Value for simulated dimension deviation

The functionality is no longer supported with the setting in GUD_MC_SIMONDEV.

For simulation in the editor (see 4. above), MEAS blocks are not executed in the measuring cycles. The setting in SD 55619 is valid for the dimension deviation.

5.2. Notes on handling L probes (type 713) in the measuring cycles

To implement "pulling measurement" (in the positive direction of the infeed axis, +Z in G17) the measuring sphere must be positioned in front of the surface/edge to be measured by the rotating the probe arm.

The specific position of the arm of the L probe, type 713, is defined by the active coordinate rotation around the infeed axis, plus the correction angle (\$TC_DP10[n]) in the tool data of the active L probe. The basic alignment of the arm for a coordination rotation of 0° around the infeed axis corresponds, taking into account the correction angle, the positive direction of the 1st measuring axis (+X).

If the measuring task requires a different alignment of the arm, then when pre-positioning, a rotation around the infeed axis is required in the user program.

Example: Measuring in +Z with L probe, probe arm alignment in +Y

```
.....  
X... ; pre-positioning axes X Y Z  
Y...  
Z...  
ROT Z=90 ; rotation around Z  
CYCLE978( , , ... )
```

In the measuring cycle, the L probe is correctly aligned by the rotating the spindle towards +Y. For pre-positioning, the "orbit" of the arm should be taken into account. Otherwise, there is a risk of collision when rotating the spindle.

The CUST_MEACYC manufacturers cycle can be adapted by suppressing unnecessary spindle positioning when measuring with the L probe:

```
.....  
_AM_WP_MES:  
.....  
IF $P_ADT[1] <> 713; <<<< ---- insert  
    IF _OVI[14]==1;          cycle is calling from the JOG-mode  
        ; IF ($SCS_MEA_FUNCTION_MASK B_AND 'B10000000000000')==0; no coupling, relating to the  
        JOG-mode  
        SPOS=0  
        ; ENDIF  
    ELSE;                    cycle is calling from the AUTOMATIC-mode  
        ; IF ($SCS_MEA_FUNCTION_MASK B_AND 'B10')==0; no coupling, relating to the AUTOMATIC-mode  
        SPOS=0  
        ; ENDIF
```

```

ENDIF
ENDIF;          <<<< ---- insert
M17

```

5.3. Notes on the boring cycle (CYCLE86)

If the "adapting the spindle position to the tool orientation" function is activated in CYCLE86 (boring) (SD 55216 \$SCS_FUNCTION_MASK_DRILL_SET Bit6=1), then internally, a correction value is calculated, and saved in the GUD variable `_MEA_CORR_ANGLE[1]`.

As it may be necessary, for selected machine kinematics, to additionally adapt this correction angle for spindle positioning, after this calculation, the `CUST_TECHCYC` is called at Marker `_M300`. There, you have the possibility of describing the correction angle `_MEA_CORR_ANGLE[0]` (for the manufacturer) and `_MEA_CORR_ANGLE[1]` (system). For subsequent spindle positioning operations, both angles act additively in CYCLE86.

5.4. Notes on using CYCLE800 in conjunction with the tool carrier and lathe with B axis

5.4.1. Description of function

For lathes (1. Turning Technology) with a B axis, it is possible to set whether the tool is oriented to "-Z" or "-X" in the basic position of the kinematics. This setting is taken into account for "Align tool" and for "Swivel plane".

Align tool

- For "Align tool", the programming of beta and gamma is machine-independent.
- With the basic position setting "Working plane" or "-Z", beta = 0 also corresponds to this basic position (compatibility).
- With the basic position setting "-X", the B axis is re-oriented through 90° for beta = 0

Swivel plane

- With the basic position setting "Working plane" or "-Z" and active working plane G17, there is no new tool orientation with swivel plane at basic position (compatibility).
 - With the basic position setting "-X" and active working plane G17, the tool orientation is turned by Y 90° with swivel plane in basic position.
- Therefore, with the basic position setting "-X", milling is possible in a swiveled plane in different working planes (G17 or G19).

The following settings and programming are not permitted and result in fault messages:

- Swivel plane, basic position -Z and G18 or G19 active
- Swivel plane, basic position -X and G18 active
- Swivel plane, swivel additive

5.4.2. Startup

Machine - setting data

MD 52200 \$MCS_TECHNOLOGY = 1 -> 1st technology turning

SD 55221 \$SCS_FUNCTION_MASK_SWIVEL_SET bit5 = 1 -> align tool absolute (TCOABS)

Swivel data set

In the swivel data set, the tool axis is defined in the basic position of the kinematics

The 100,000th position in `$TC_CARR37` has the following significance:

- 0: Basic position: active work plane corresponding to G17 G18 G19 (compatibility)
- 1: basic setting: - Z (tool axis in the – Z direction)
- 3: Basic position: - X (tool axis in the – X direction)

Kinematik Kanal 1		Werkzeugachse in - X Richtung	
Name	MIXED_BC	Kinematik	Schwenkkopf+ Schwenktisch
Nr.	1		
Freigabe	ja	Grundstellung	-X
Freifahren	Z oder Z, XY oder in Wz-Richtung max. oder in Wz-Richtung inkr.		
	X	Y	Z
Freifahrposition	1.000	1.000	1.000 mm
Offsetvektor I1	-25.340000	0.000000	-113.770000 [mm]
Rundachsvektor U1	0.000000	1.000000	0.000000
Offsetvektor I2	25.340000	0.000000	113.770000 [mm]
Offsetvektor I3	-65.560000	-44.650000	0.000000 [mm]
Rundachsvektor U2	0.000000	0.000000	-1.000000
Offsetvektor I4	65.560000	44.650000	0.000000 [mm]
Schwenkmodus	achsweise		
Rundachsen direkt	ja	Nachfahren WZ	nein
Projektionswinkel	nein	B-Achskinematik	nein
Raumwinkel	nein		
Richtungsbezug	Rundachse 1, Richtungsauswahl -		
JobShop Funktionen	Schwenkdatensatzwechsel automatisch		
	Werkzeugwechsel automatisch		

Input screen form, swivel data set: Example, basic position of the tool axis -X

5.5. CYCLE790 new cycle to optimize the friction compensation

CYCLE790 is generated from the commissioning screen to optimize friction compensation.

When executing the cycle with NC start, either a circle or reversing motion of a linear/rotary axis – or spindle is executed. The optimization is performed in 9 steps. The axes to be optimized must be pre-positioned in JOG mode before opening the optimization so that collision-free movement by twice the value of the SD 55820 setting data (radius) is possible. The cycle is exited after successful optimization or by initiating a RESET. On continuation of the steps, intermediate positioning at the starting position with the highest feedrate in the SD 55822 setting data field takes place. The CYCLE790 can also be used when there is no machining technology set in the MDs 52200 and 52201.

The following channel setting data is used for CYCLE790:

SD 55820 \$SCS_FRICT_OPT_RADIUS radius for optimization of linear axes

Default value 10mm

SD 55821 \$SCS_FRICT_OPT_RADIUS_ROT radius for optimization of rotary axes

SD 55822 \$SCS_FRICT_OPT_FEED[9] feedrates for optimization of the friction compensation for linear axes [mm/min]

SD 55823 \$SCS_FRICT_OPT_FEED_ROT[9] feedrates for optimization of the friction compensation for rotary axes [mm/min]

SD 55824 \$SCS_FRICT_OPT_STEP optimization step number

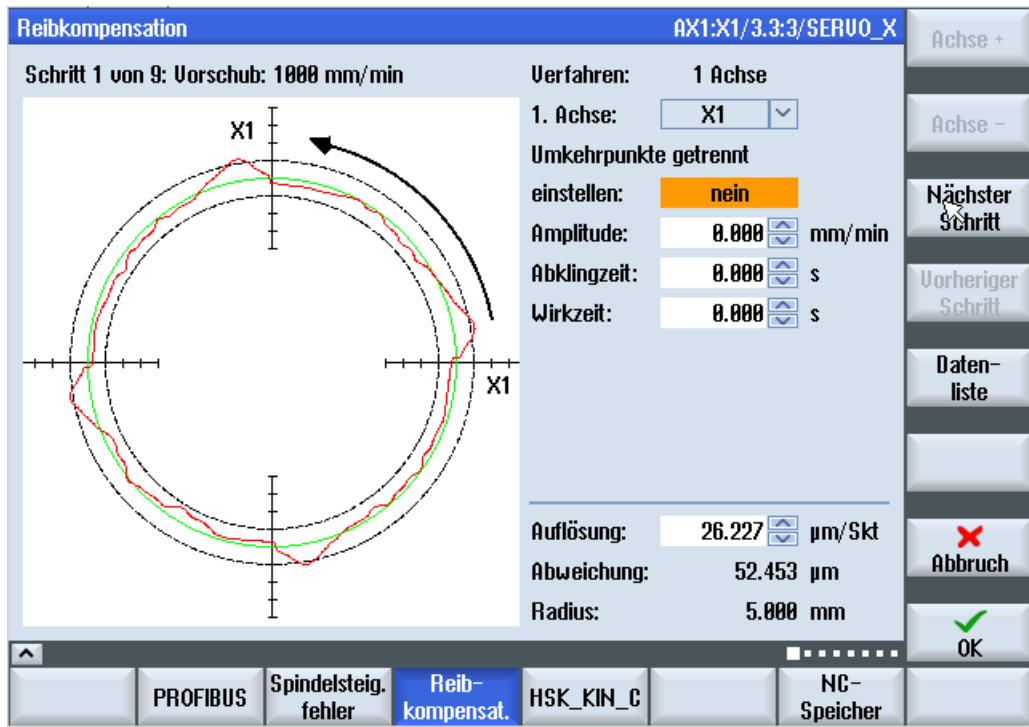
SD 55826 \$SCS_FRICT_OPT_ACT_STEP current optimization step number (for internal use only)

SD 55828 \$SCS_FRICT_OPT_DIR_MINUS direction of rotation of the optimization

0=circular movement with G2 1=circular movement with G3

If "Traverse 1 axis" is selected, SD 55828 has no meaning.

CYCLE 790 is generated exclusively from the HMI interface in the area of commissioning/NC/friction compensation:



Optimization of the friction compensation of axis X

Known fault 04.01.00.00 BL06:

1. The movement arrow is sometimes displayed incorrectly
2. Measurement units for optimization of a rotary axis are displayed incorrectly.
3. If "Traverse in 2 axes" is selected and an axis that is not a geometric axis has been selected, it is not possible to move in a circle (fault message may be confusing). Optimization of a rotary axis or a channel axis is carried out by selecting "Traverse: 1 axis".

5.6. Logging measurement results in the automatic program

Function scope:

- Every measurement cycle generates a standard log when opened in the automatic program
- The log can be created either in text format or tabular format. Tabular format means that it can be exported to Excel.
- The measurement results screen is switched on and off by opening CYCLE150

Programming:

- Logging is switched on and off by programming CYCLE150. This can be programmed via a screen in Operate.
- The logging function can either be switched off by opening CYCLE150 again or it is switched off automatically when the program is closed.

Example:

```
CYCLE150(30,1,"/NC/MPF.DIR/PROT_TE_977_4BOH.TXT") ; log on
CYCLE977(101,10005,,1,24,,,2,8,0,1,1,,,1,"",,0,1.01,1.01,-1.01,0.34,1,0,,1,1) ; measuring cycle
```

Operator action:

- Entry softkey for the input screen of CYCLE150 is VSK8 "Measurement result" under "Measure workpiece" or "Measure tool"
- The following can be selected on this screen:
 - o Log type: "Standard log" / "User log"
 - o Log format: "Text format" / "Tabular format"
 - o Log file: "New"/"Append"
 - o Log storage: Path and name for log file

For commissioning:

- The following MD/SD settings are required for logging:
MD 11422 \$MN_PROTOCOL_FILE_MODE Bit0 = 1
If larger log files are to be saved in the NCK file system, it may be necessary to increase the
MD 11420 \$MN_LEN_PROTOCOL_FILE

Not yet possible:

- Logging on an external drive is not yet possible – will be achieved with EES

5.7. Expanded functionality CYCLE996

This section describes the new function in CYCLE996.

5.7.1. CYCLE996 checking of the diameter of the sphere

When measuring the calibration sphere (1.2.3. measurement) the measured diameter (actual diameter) of the calibration sphere is saved to the following result parameters:

_OVR[72] to _OVR[74] -> Actual diameter of calibration sphere 1.2.3.measurement rotary axis 1

_OVR[75] to _OVR[77] -> Actual diameter of calibration sphere 1.2.3.measurement rotary axis 2 (if rotary axis present)

If SD 55644 \$SCS_MEA_KIN_DM_TOL > 0, after the 1st measurement and when calculating the kinematics, the measured calibration sphere diameter is checked. If the deviation is greater than in setting data SD 55644 \$SCS_MEA_KIN_DM_TOL, fault 62321 or 62322 is output.

62321 rotary axis 1: Tolerance, diameter calibration sphere between measurement %4 exceeded.

62322 rotary axis 2: Tolerance, diameter calibration sphere between measurement %4 exceeded.

5.7.2. CYCLE996 scaling of rotary axis vectors V1 and V2

User-specific scaling of rotary axis vectors V1 and V2

When calculating the kinematics, the vectors can be calculated as unit vector or as a user-specific vector. In the case of a user-specific rotary axis vector, one vector component is always either 1 or -1. The other two vector components are converted with a corresponding factor.

Activating the function: Setting data SD 55740 \$SCS_MEA_FUNCTION_MASK Bit9.

Example: Swivel head with 45 degrees rotary axis

1. Vector V2xyz as unit vector after calculation of the kinematics (SD 55740 bit9=0):
\$TC_CARR10[1]=**0.7070974092**
\$TC_CARR11[1]=-1.823908EX-06
\$TC_CARR12[1]=**0.7071161531**
2. Vector V2xyz user-specific after calculation of the kinematics (SD 55740 bit9=1):
\$TC_CARR10[1]=**0.9999734924**
\$TC_CARR11[1]=-2.579361244EX-06
\$TC_CARR12[1]=**1**

If SD55740, bit 9=1 is set, for comparison purposes, vectors V1 and V2 are saved in the result parameters

_OVR[98] up to _OVR[103] before calculating the user-specific scaling. Result parameters _OVR[98] to _OVR[103] are also written to the measuring data file.

_OVR[98] vector V1x after calculating as unit vector (without user-specific scaling)

_OVR[99] vector V1y after calculating as unit vector

_OVR[100] vector V1z after calculating as unit vector

_OVR[101] vector V2x after calculating as unit vector (without user-specific scaling)

_OVR[102] vector V2y after calculating as unit vector

_OVR[103] vector V2z after calculating as unit vector

5.8. Grinding cycles – Functional scope

5.8.1. Cycles for synchronous oscillation

The functional scope of grinding cycles is described in the document /7/.
These cycles use the functional scope of G71ff, with F.

List of cycles:

CYCLE4071	Longitudinal grinding with infeed at the point of reversal	A	
CYCLE4072	Longitudinal grinding with infeed at the point of reversal and measurement control	A	
CYCLE4073	Longitudinal grinding with continuous infeed	A	
CYCLE4074	Longitudinal grinding with continuous infeed and measurement control	A	
CYCLE4075	Flat grinding plunge grinding		F
CYCLE4077	Flat grinding plunge grinding with measurement control		F
CYCLE4078	Surface grinding with continuous infeed		F
CYCLE4079	Surface grinding with intermittent infeed		F

A ... Technology external cylindrical grinding

F ... Technology flat grinding

5.8.2. Cycle for profiling

The functional scope of grinding cycles is described in the document /7/.

List of cycles (this applies both for flat and external cylindrical grinding):

CYCLE495	Profiling
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For programming, s. /7/

5.8.3. Setup cycles

The functional scope of grinding cycles is described in the document /7/.

List of cycles (this applies both for flat and external cylindrical grinding):

CYCLE400	Align grinding wheel
CYCLE401	Measure dresser (auxiliary cycle for dressing)
CYCLE435	Calculate dresser position (auxiliary cycle for dressing)

These cycles are not programmed by the user, but called up in the background from dialogs in the menu Machine / JOG.

5.8.4. Machine data settings required for grinding

The following machine data settings are currently required:

- Check and/or set the following MD settings:
 - MD 20310 \$MC_TOOL_MANAMGENT_MASK Bit 0 =1 and Bit 14 = 1
(only due to preconfigured magazine file with manual tools)
 - MD 22562 \$MC_TOOL_CANGE_ERROR_MODE Bit 1 =1
(only due to preconfigured magazine file with manual tools)
 - MD 52000 \$MCS_DISP_COORDINATE_SYSTEM = 16 (!!! With rotary grinding only)
 - MD 52200 \$MCS_TECHNOLOGY = 3 or 4

MD 52270 \$MCS_TM_FUNCTION_MASK Bit 5 = 1
Bit 5 Use grinding configuration file

MD 52840 \$MCS_GRIND_FUNCTION_MASK='H80'