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This document serves as a guide for the software update to SINUMERIK 840D sl CNC Software 4.7 SP4.

We kindly request you to carefully read through this document, as it comprises essential information for the installation and use of the software.

The following binding notes supersede the statements made in other documents. Additional information is provided in the following documents:

<table>
<thead>
<tr>
<th>Name</th>
<th>File</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function improvements</td>
<td>Behobene_Funktionseinschraenkungen.pdf</td>
</tr>
<tr>
<td>Supplementary conditions</td>
<td>Randbedingungen.pdf</td>
</tr>
<tr>
<td>Cycles</td>
<td>siemensd/e_appendix_cycles.pdf</td>
</tr>
<tr>
<td>Emergency Boot System</td>
<td>Emergency Boot System.pdf</td>
</tr>
</tbody>
</table>
1 SOFTWARE COMPONENTS

The CNC Software 4.7 SP4 (internal version 04.07.04.00.018) comprises the following components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCK (incl. NRK)</td>
<td>V99.19.02</td>
</tr>
<tr>
<td>SNCK</td>
<td>V04.07.03.00.001</td>
</tr>
<tr>
<td>SINAMICS</td>
<td>V04.74.35.02</td>
</tr>
<tr>
<td>PLC OpSys (317-3)</td>
<td>V32.83.27</td>
</tr>
<tr>
<td>PLC OpSys (319-3)</td>
<td>V32.83.27</td>
</tr>
<tr>
<td>FB15(sl)</td>
<td>V04.07.27</td>
</tr>
<tr>
<td>CP</td>
<td>V02.38.00</td>
</tr>
<tr>
<td>MCP_CLIENT</td>
<td>V01.06.06</td>
</tr>
<tr>
<td>SINUMERIK Operate</td>
<td>V04.07.04.00.016</td>
</tr>
<tr>
<td>Linux basic system</td>
<td>V04.71.04.00</td>
</tr>
<tr>
<td>NCK file system driver</td>
<td>V04.07.01.03.001</td>
</tr>
<tr>
<td>NCU-Link Config (SDBs for the configuration of NCULink)</td>
<td>V03.00.00</td>
</tr>
<tr>
<td>Profinet FW</td>
<td>14.01.06.04</td>
</tr>
<tr>
<td>Cycles</td>
<td>V04.07.67.02</td>
</tr>
<tr>
<td>HMIARC Tool</td>
<td>04.07.02.02.001</td>
</tr>
<tr>
<td>SinIntClient</td>
<td>03.00.06.00.022</td>
</tr>
</tbody>
</table>
2 NEW FUNCTIONS

New functions as from SW4.7 SP4:

None
3 PREREQUISITE

3.1 Software

- NCU Service System >= V04.70.47

3.2 Hardware

- The CNC SW 4.7 SP4 may only be operated on SINUMERIK NCUs 710.3 PN / 710.3B PN, 720.3 PN / 720.3B PN and 730.3 PN / 730.3B PN.
- NCU 7x0.3 modules with boot code of PLC Version V2.5 (see also Chap. "Boot code...")

3.3 Storage media

- 8 GB CF Card Smart Modular Xceed. - For the standard version 6FC5851-1XG41-_YA8.

3.4 Tools

- Step 7 Version as from V5.5 SP4
- Current Toolbox as from V 04.07.23.00
- Create MyConfig as from V4.7 SP2

3.5 Other Requirements

- For the internal use of SINUMERIK Operate on NCU, you require the option S00 SINUMERIK Operate on NCU in combination with real drives
- For the external use of SINUMERIK Operate on PCU or PC, you require the option P87/P88 SINUMERIK Operate on PCU / PC in combination with real drives
4  INSTALLATION

4.1  Installing the CNC software

The NCU Service System >= V04.70.47 on USB stick is required to install the CNC software. New installations can be performed via the NCU service system and TCU or with WinSCP / AMM /P2P from V4.6 SP1 HFx.

An upgrade or new installation can also be carried out using the tools of the Create MyConfig Version from V4.7 SP2. To do this, a CMC package must be generated that is stored and booted either on a PG, PC, a PCU or a USB stick at the NCU or PCU. The relevant instructions are included in the Create MyConfig manual.

The software may only be installed on a SINUMERIK 8 GB CF card - see requirements.

4.2  Boot code of the PLC

The Software Version 4.7 only starts with PLC boot code V2.5 (or later) internally coded on the NCU hardware. If this PLC boot code has not yet been installed, the control will not start (in this case, the 7-segment display shows “PLC” and SF and DP LED flash red).

In this state, the boot code upgrade can be initiated by actuating the PLC rotary switch. The boot code is flashed by turning the PLC rotary switch into position 5. This can be identified by the fact that a rotating wheel is displayed in the 7-segment display. This takes approx. 15 s. With this procedure, under no circumstances is it permissible that the NCU is switched off! The 7-segment display goes dark after the boot code upgrade has been completed. The PLC rotary switch can now be turned back to position 3 (general reset) and the system continues to boot.

4.3  Installing the NCU service system on USB stick

The NCU service system is stored as a USB stick image in the directory emergency_bootsys_ncu on the supplied DVD. The copy program installdisk.exe is also included. Connect a USB stick >= 2 GB to your PG respectively PC and determine the relevant drive letters. Call installdisk to copy the NCU service system to the USB stick:

```
installdisk --verbose --blocksize 1m <Image file> <Drive letter:>
```

It is best if the command specified above is executed in a DOS shell. For this, you require administrator rights on your PG/PC. Sequence of screens for the NCU service system – Generate a separate file “Emergency Boot System.pdf”

Alternatively, the image can also be installed using the tool AccessMyMaschine /P2P as from V4.6 SP1 HFx via the menu item "Write file system image”.

Installation on the NCU:
Upon completion of installdisk, remove the USB stick from the PG / PC, boot once an NCU 7x0 from this stick (this boot process takes a little bit longer; a “P” in the 7-segment display of the NCU indicates that the FAT partition of the USB stick is partitioned) and reinsert the stick in the PG / PC. Under Windows, you can now see an empty USB stick. Now copy the requested CNC software (file with extension .tgz) from the directory ncu_sw on the DVD supplied. The USB stick can be connected to one of the two USB connectors of the NCU 7x0.3. The NCU will boot from this USB stick after power ON. The system is operated either via a TCU that is connected to the NCU, or via PG / PC using WinSCP under "Open Terminal".

Instructions on how to use the NCU service system can be found in the documentation /IM7/ on the DVD supplied. We recommend that you use the USB stick “SIMATIC IPC USB Flashdrive, 6ES7648-0DC60-0AA0”.

---
5 NOTES AND RESTRICTIONS

5.1 General notes

The HMI-Pro sl software as from V04.05.03.04 can be used in combination with the CNC SW 4.7 SP4.
The additional languages V4.7.3 can be used. New texts from SW 4.7 SP4 may be displayed in English.
The following functions / options are not released:
- F-PLC, that means no 317F and 319F, thus SINUMERIK with dbSi1 either
- HTL/TTL encoder in combination with HLA and safety
- The CBA function may only be used together with a declaration regarding machine-specific release.
- AST from part program (ASTCMD): Gantry axes are not supported

The option 6FC5800-0AP72-0YB0 Run MyRobot /Handling position is not displayed in SINUMERIK Operate under "Licenses -> All options". The option bit for MyRobot /Handling position display is 19730[1] Bit 27 and can be set under "General MD".
If this option is set, it is also displayed in the license screen, where it can also be deactivated.

5.2 Notes regarding the CNC software

As from SW 4.7 SP3 HF1, the option S17 Top Surface is generally available, the following notes must be taken into account:
- Operation only alternatively to Advanced Surface with moldmaking applications.
- The setting instructions for Advanced Surface and Top Surface must be complied with – see https://support.industry.siemens.com/cs/ww/de/view/109738423
- The current secondary conditions from Advanced Surface are to be complied with.
- Operation only with NCU 7x0.3B hardware, the NCU 710.3B hardware is only conditionally suited for Top Surface.
- In terms of resources, 5(6)-axis simultaneous machining should only be implemented with 720/730.3B hardware.
- Top Surface may only be configured in the first and another channel and only active in a single channel.
- Only with inactive collision avoidance in AUTOMATIC mode.
- NCU utilization: IPO/position controller and possibly PLC approx. 3 0% (visible under system utilization diagnostics)
- Operation only without 3D WRK, that means only without CUT3Dx.
- Only without synchronous spindle coupling, without programmable axis couplings.

With Top Surface, the tolerance value from CYCLE832 is used for the contour – in contrast to Advanced Surface, where the tolerance value is used for the axis tolerance. When comparing Advanced Surface with Top Surface, this yields a difference of SQRT(3) between the active contour tolerance and possibly surface and speed respectively machining time differences.
With Top Surface, an enhanced jerk consideration is performed, compared to Advanced Surface.
If the data throughput of data-intensive part programs leads to a reduction of the IPO buffer filling level, the FIFOCTRL function reduces the path velocity in order to prevent stopping of the system.

- Changes regarding thread cutting as from SW 4.7 SP3 HF2:
The following changes apply regarding thread cutting (G33-35):
Geometric rounding in thread run-out blocks with the setting data SC_THREAD_RAMP_DISP[1]=-1 is now performed as smoothly as possible. For the existing harsh behavior, you must enter 0 instead of the default -1.
There is a new setting data SC_THREAD_RAMP_DISP[2] with the following meaning:
With the default -1, the geometric rounding process between thread blocks is performed as smoothly as possible. For the existing harsh behavior, you must enter 0 instead of the default -1.

- The NC option alarm is a Power-On alarm with the standard and export versions.
  Exception: Simulators without real drives.

- When upgrading the system from V4.5 SPx and having licensed all options, the options P87 and P88 (Operate on PC respectively PCU 50) may have to be licensed subsequently following the upgrade.

- Auto Servo Tuning - AST
  When upgrading the system from CNC SW < V4.5 SP3, the stored AST session files (Auto Servo Tuning) are not compatible and the AST settings (strategy, measurement parameters, etc.) get lost.
  The standard directory for XML files has been modified from card/user/sinumerik/hmi/log/optimization (SW 4.5) to card/user/sinumerik/nck/data/optimization (as from SW 4.7SP2). You can perform an XML export. The files are stored under card/user/sinumerik/nck/data/optimization. When using “Clear History”, a backup is stored under card/user/sinumerik/nck/data/optimization/backup.

- SinuComARC
  Series commissioning archives can no longer be edited with SinuComArc.
  Alternatively, you can use Create MyConfig (for example, also CMC Diff) respectively AMM /P2P as from V4.7 SP2; does not claim to be a successful competitor.

- Synchronized actions:
The number range from 1 to 999 is generally available and compatible with the existing behavior.
The number range can be used as usual by all users (users, OEMs).

- Restrictions with EES:
  When using a USB stick on the TCU in combination with a PCU, you can currently not edit any files on the USB stick with active EES mode. These files can, however, be executed.
  If a USB stick on a TCU is accessed by several HMIs / NCUs in parallel, the components are not coordinated. This entails the danger that a program being processed is modified / destroyed by another component.

- When using SinuComNC trace, you must ensure with PLC signals that the configured signals (data blocks, data bytes) are provided in the PLC.

- Problem solution for S5_FETCH / S5_WRITE in the CP:
  As from SW 4.7 SP1, the file cp_param.ini containing the following contents is stored on the CF card in the directory /siemens/sinumerk/cp:
  
  [IniFile_ID]
  Version = 100
  Type    = 'CosCP'
  Comment = 'Select fetch/write version'
  
  If you modify this file, don't remove the section [IniFile_ID] above.
  Check 'cp_param.log' to verify that your settings are accepted.

  [FetchWrite]
# Selection of the S5 fetch/write implementation
# Version = 1 : the previous behavior
# Version = 2 : the new as far as possible CP 343 compatible behavior
Version = 1

The problem solution becomes active when recopying this file (possible as manufact) into the directory /user/sinumerik/cp and modifying the entry "Version = 1" in "Version = 2".

- When traversing at low speeds, alarm 27011 is triggered during traversing movements in the negative direction.
  The following supplementary conditions must be considered a remedy for the described behavior:
  The minimum possible resolution (quantization) of the monitoring functions for Safety Integrated is one increment per monitoring cycle [incr/mcc].
  Two increments per monitoring cycle are necessary, so that no speed violation alarm is triggered when the axis is stationary.
  The minimum speed limit value that can be set for the machine data $MA_SAFE_VELO_LIMIT$ can be determined as follows:
    For a rotary axis:
    \[
    Example 1: Monitoring cycle = 12 ms, LimitMin=2[incr/mcc]
    \[
    \text{\$MA_SAFE_VELO_LIMIT = 2[incr/mcc] \times 60[s/min] / 360[deg/rev] / 1000[incr/deg] / 0.012[s/mcc] = 0.02777.. [rpm] => rounded 0.028[rpm]}
    \]
    Example 2: Monitoring cycle = 8 ms, LimitMin=2[incr/mcc]
    \[
    \text{\$MA_SAFE_VELO_LIMIT = 2[incr/MC] \times 60[s/min] / 360[deg/rev] / 1000[incr/deg] / 0.008[s/mcc] = 0.04166.. [rpm] => rounded 0.042[rpm]}
    \]
    With decimal places, the value has to be rounded to be entered for the machine data.
    For a linear axis:
    \[
    \text{\$MA_SAFE_VELO_LIMIT\[mm/min\] = 2[incr/mcc] \times 60[s/min] / 1000[incr/mm] / MCC[s/mcc]}\]
    Example 1: Monitoring clock cycle = 12 ms, LimitMin=2[incr/mcc]
    \[
    \text{\$MA_SAFE_VELO_LIMIT\[mm/min\] = 2[incr/mcc] \times 60[s/min] / 1000[incr/mm] / 0.012[s/mcc] = 10[mm/min]}
    \]
    Example 2: Monitoring clock cycle = 8 ms, LimitMin=2[incr/mcc]
    \[
    \text{\$MA_SAFE_VELO_LIMIT\[mm/min\] = 2[incr/mcc] \times 60[s/min] / 1000[incr/mm] / 0.008[s/mcc] = 15[mm/min]}
    \]
    With decimal places, the value has to be rounded to be entered for the machine data.
    Actual speed value:
    At very low speeds, the possible minimum resolution of the actual speed value must also be considered; this value depends on the encoder pulses per revolution, the gear ratio and the monitoring clock cycle!

SINAMICS display parameters for the speed resolution:
The drive provides a display parameter for the speed resolution, which is also visible with ncSI r9732[0..1] SI Motion speed resolution
For Index 0:
Display of the safe speed resolution (load side). Specification of speed limits or parameter changes for speeds below this threshold have no effect.
For Index 1: Display of the safe speed accuracy based on the safe encoder accuracy. Unit: mm/min or rpm
Use with ncSI:
With a 1-encoder system, the above-mentioned display parameter r9732[0..1] “SI Motion speed resolution” can be used as a basis for the setting of the minimum limit values by the user. You must double the value displayed in r9732[0] for parameterization, so that no speed violation alarm is triggered when the axis is stationary.
With a 2-encoder system, the value displayed for r9732 is only valid for the encoder parameterized for SINAMICS. The speed resolution of the encoder for the NCK can vary from this value!
As already stated above, this parameter alone does not provide any information on the actual accuracy of the speed measurement. This depends on the type of actual value sensing, the gear ratios and the quality of the encoders used.

- Adjustment of the default machine data in the area “Saving of persistent data”. With the values set, the number of write processes onto the CF card has been reduced.

  a) Change of the memory default values for saving persistent data on the system CF card

<table>
<thead>
<tr>
<th></th>
<th>Old</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>N17610 $MN_DEPTH_OF_LOGFILE_OPT_PF[0]=</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>N17610 $MN_DEPTH_OF_LOGFILE_OPT_PF[1]=</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>N17610 $MN_DEPTH_OF_LOGFILE_OPT_PF[2]=</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>N18232 $MN_MM_ACTFILESYS_LOG_FILE_MEM[0]=</td>
<td>2</td>
<td>400</td>
</tr>
<tr>
<td>N18232 $MN_MM_ACTFILESYS_LOG_FILE_MEM[1]=</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>N18232 $MN_MM_ACTFILESYS_LOG_FILE_MEM[2]=</td>
<td>3</td>
<td>30</td>
</tr>
</tbody>
</table>

  b) In order to keep the preprocess running during the Flush process, the system has been set to asynchronous flush by default.

  N18234 $MN_MM_MEMORY_CONFIG_MASK= 1

Note:
After loading the archive, the new default values remain only topical if the “old” default values are not changed and an archive has been created with MD11210=FF MD11212=1.

- When activating TRAILON using a synchronized action with active transformation (TRAORI), an incorrect coupling may occur if a RESET is triggered with active coupling. In case of a RESET, the transformation is deactivated for an IPO cycle. As a result, a setpoint is specified in the MCS instead of BCS. Thus, the coupling is made for the machine axis instead of the geometry axis, which leads to a position jump. TRAILON interpolates this jump and generates a movement to an incorrect coupling position (MCS), which leads to large and quick axis movements.

  Solution:
  The user must ensure that the transformation is active with activated TRAILON and the triggering / setting of RESET is suppressed in the PLC.

- TRANSMIT and Safety:
  When performing machining operations close to the pole, the feedrate is reduced. With the setting $MC_LOOKAH_FUNKTION_MASK Bit1=1, the feedrate is no longer reduced.

- The function G643 (block-internal approximate positioning) has been released for tool change applications (e.g. optimizations when approaching the tool change position). It has not been released for machining applications.

- The function G644 (approximate positioning with maximally possible dynamics) has been released for tool change applications (e.g. optimizations when approaching the tool change position). It has not been released for machining applications.

- Safety/Diagnostics: No display of the SAFE.SPF checksum.
  If, in SAFE.SPF, the line with the variable SAFE_CHECKSUM is not displayed in line 1, no checksum is displayed for SAFE.SPF under Safety/DIAGNOSTICS/checksums.

  Solution:
ET200-PN as NCK I/Os:
The plausibility check in the NCK can be deactivated via MD 11415, Bit 24. Thus, the ET200SP PN modules
can be used as clock-synchronous I/Os on the Sinumerik. However, the configuring engineer must ensure
that his Step 7 hardware configuration is consistent and conforming with Sinumerik (Ti, To and Tdp must
always have the same values for drives / I/Os which must be served by the NCK).

SSH port 22 on X130 interface:
For security reasons, the SSH port 22 on the X130 interface is disabled in the firewall as from SW 4.7 SP1.
As a consequence, the controller can no longer be accessed from external sources via this interface. This
concerns, among others, Operate on PCU/IPC/PC (which uses this for several functions), WinSCP and
AMM.
The port can be permanently activated in Operate (only possible on the NCU) under Commissioning ->
Network -> Company Network -> Change -> Checkbox “SSH (TCP/22)”; see screenshot:

Alternatively, you can make a manual entry in the file /user/system/etc/basesys.ini (such as the ports 102
and 5900 are activated).

NAT forwarding/routing
The “NAT forwarding/routing” for the Ethernet interfaces X120 and X127 has been deactivated by default to
ensure that the company network at X130 can no longer be reached by these interfaces. In order to
reactivate this routing, you must set the entry DisableNATRouting=0 in the file basesys.ini. This can also be
done from Operate.

Network connections with authentication NTLMv2 are currently not supported.
The Operate dialog ‘Change password’ only changes the password for the NCK. This change does not affect
the NCU basic system. The passwords in the NCU basic system (Linux) must be changed separately.
5.3 Notes regarding Toolbox V04.07.23

Regarding the Toolbox V04.07.27, we recommend that you use STEP7 V5.5 SP4 HF7 or later.

If no new functions from Software 4.7 are used, you need not upgrade the PLC user program to the basic program version 4.7. PLC basic user programs Version 4.5 (or later) are functional.

When configuring an HLA hardware, you may only change the telegrams as from slot (object) 1 from 136 to 166.

S120 drives on Profinet isochronous:
Configuring via the NCU is supported, it is not supported via the IO device.

With an isochronous alarm of the NCU, select the setting for the Ti/To mode as “fixed” rather than “in IO device”.

Upgrading the system Software Version 4.7 using the existing PLC user program causes a problem to arise with the Toolbox >= V04.07.21 at the call interface of the FB1 in the OB100.

Inserting the new parameter “MCP_IF_TCS” results in a change to the call interface of the FB1. This causes the user to receive an error message from Step 7 after inserting the blocks from the Toolbox >= V04.07.21. This error message only occurs if the OB100 is opened.

This situation has improved in Toolbox V04.07.27, the block call FB1 “RUN_UP” has to be updated once and then the call parameters are displayed without any time stamp conflict.
5.4 Notes regarding the use of the Starter

Starter Version V4.4 SP1 or later must be used.

5.5 Notes regarding SINUMERIK Operate

- When using SIMATIC ITC panels, no touch softkey is available for the help function.
- For touch panels without keyboard, a vertical softkey “Cancel alarm” is now provided in the alarm screens of the Diagnostics area.
- Use the softkey “Save parameter” (in the Program Manager under “Archive”) to save the R parameters and user variables belonging to a specific workpiece. To ensure that the softkey “Save parameter” is displayed, the machine data MD 11280 $MN_WPD_INI_MODE must show the value 1.
- The mold and die view cannot be used with POLY and G91 blocks.
- The mold and die view cannot be used with BSPLINE blocks.
- Only the elements 0 to max. 65534 can be displayed respectively changed in GUD arrays, even if the array is greater in the NC.
- The option P77 “CNC user memory extended” is now also provided for the local drive of the PCU.
The display of the internal Operate is now permanently set to a 32-bit color depth.

Tool management, incorrect display of magazine location texts:
If the magazine locations are provided with language-dependent texts, the texts are always displayed in English if the source starts with a digit.

New Design:
A new “skin” (new design) has been added to Operate. This new skin changes the appearances of the softkeys including the icons on the softkeys, the appearance of the window title bars, various colors (window background colors), and the appearance / behavior of the header. The displays for operating area and operating mode can be found on the right side of the header line and, with no alarm pending, the header only shows the Siemens logo.
The new skin can be activated via the display MD 9112 HMI_SKIN = 1. After a restart, Operate uses the new skin.

With multitouch operation (e.g. OP015 black / OP019 black), the functions of the user interface have also been expanded. There are six functions keys above the vertical softkeys which are always visible for the functions Undo, Redo, Open/Close online help, Open/Close virtual keyboard, Open/Close pocket calculator, Create screenshot.

When executing part programs from network drives or editing files on network drives, the user must provide for a stable, interference-free network connection to the network drives.

OPC-UA:
There are two possibilities to set up a connection:
• Connection without security
• Connection with the security policy "Basic128Rsa15" respectively “Basic256” and the security mode “SignAndEncry”
Siemens recommends that you always establish a connection with security, as only in this way the confidentiality of the data transferred can be ensured.

When restarting Operate, it may occur that the reconnection with the OPC server fails. In this case, you must restart NCU respectively PCU 50 / IPC.

5.6 Note regarding the Siemens cycle packages
CNC SW 4.7 SP4 contains the following cycle packages on the CF card:
• Technological cycles (standard cycles)
• Measuring cycles
• ISO cycles
• ShopMill cycles
• ShopTurn cycles
• Grinding cycles
• AST cycles
• Adapting Cycles
All these Siemens cycles are automatically loaded into the NC during the runup of the NCU. The corresponding variables are stored in the definition file PGUD.

Note:
The “programGUIDE” in SINUMERIK Operate is based on the cycle packages of CNC SW 4.7 SPx. Cyle calls in part programs for these cycles cannot be recompiled or processed with the cycle support in HMI-Advanced 7.x.