



## Faulhaber CO @ Beckhoff

### Summary

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This application note describes the necessary steps to control a FAULHABER MC V 2.5 / V3.0 CANopen version using a TwinCat based PLC. The MC is connected via CANopen to the PLC

### Applies To

Faulhaber Motion Controller CO (Firmware Version C), Beckhoff SPS with NC kernel, TwinCat 3

### Description

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Before it is possible to use the Motion Controller in a PLC environment, following configurations have to be done with the Motion Manager:

- Configure baudrate and set node number

At the first start-up of the MC the baudrate and the node number have to be set via LSS-protocol (Motion Manager).

Later the baudrate of the CANopen Gateway needs to be set on the same value.

- Deactivate Heartbeat

0x1017 Producer heartbeat := 0;

0x1016 Consumer Heartbeat := 0;

- Activate Node Guarding

0x100C Guard Time z.B. := 100;

0x100D Life Tim Factor z.B. := 3;

It is possible to configure the heartbeat and node guarding with the object dictionary of the Motion Manager or the CoE Object dictionary of the TwinCat System.

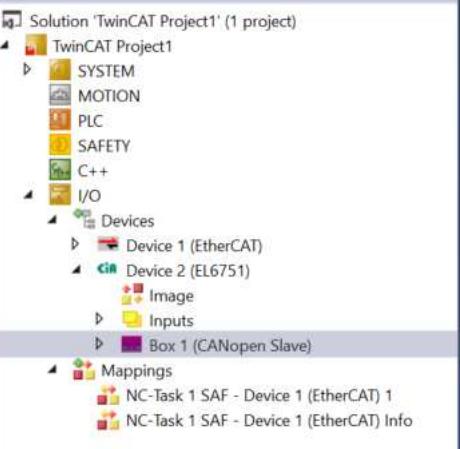
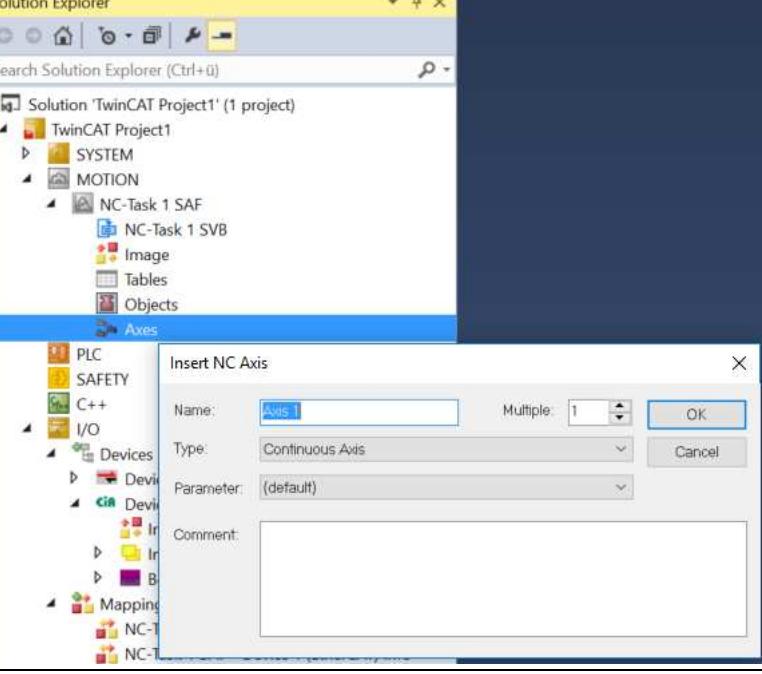
#### Important:

In case that a homing sequence is necessary for the application, it has to be executed by the PLC Master.

In this constellation we don't recommend to use the Faulhaber homing methods.

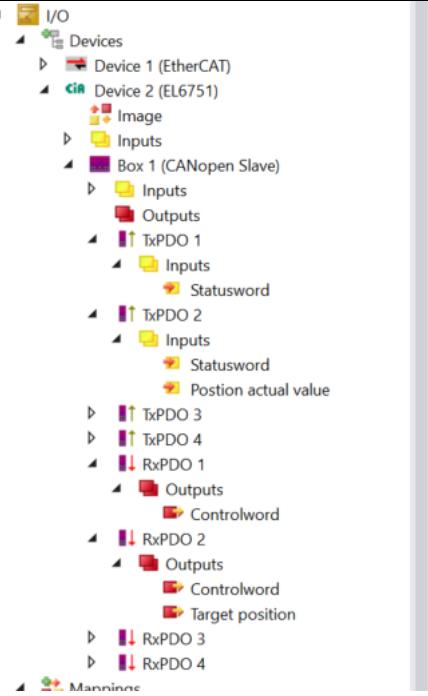
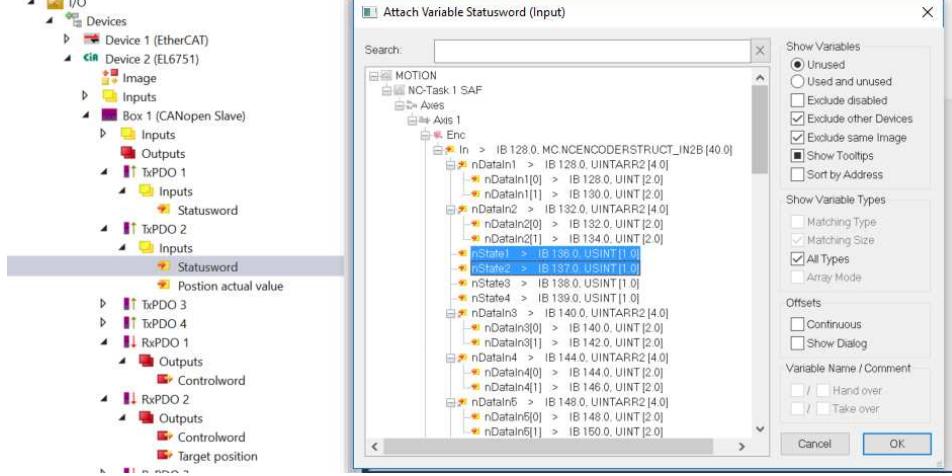
After the pre-configuration of the MC is done, you can continue with the configuration of the plc master.



Nr	Screenshot	Description
1	 Solution 'TwinCAT Project1' (1 project) <ul style="list-style-type: none"><li>▶ TwinCAT Project1<ul style="list-style-type: none"><li>▷ SYSTEM</li><li>▷ MOTION</li><li>▷ PLC</li><li>▷ SAFETY</li><li>▷ C++</li><li>▷ I/O</li><li>◀ Devices<ul style="list-style-type: none"><li>▷ Device 1 (EtherCAT)</li><li>◀ Device 2 (EL6751)<ul style="list-style-type: none"><li>▷ Image</li><li>▷ Inputs</li></ul></li><li>▷ Box 1 (CANopen Slave)</li></ul></li><li>◀ Mappings<ul style="list-style-type: none"><li>▷ NC-Task 1 SAF - Device 1 (EtherCAT) 1</li><li>▷ NC-Task 1 SAF - Device 1 (EtherCAT) Info</li></ul></li></ul></li></ul>	<ul style="list-style-type: none"><li>- Create new Twin-Cat solution</li><li>- Add BUS slaves with „Scan“ function or manually</li></ul>
2	 Solution Explorer Search Solution Explorer (Ctrl+ü)  Solution 'TwinCAT Project1' (1 project) <ul style="list-style-type: none"><li>▶ TwinCAT Project1<ul style="list-style-type: none"><li>▷ SYSTEM</li><li>◀ MOTION<ul style="list-style-type: none"><li>◀ NC-Task 1 SAF<ul style="list-style-type: none"><li>▷ NC-Task 1 SVB</li><li>▷ Image</li><li>▷ Tables</li><li>▷ Objects</li></ul></li></ul></li><li>◀ Axes<ul style="list-style-type: none"><li>PLC</li><li>SAFETY</li><li>C++</li><li>I/O</li><li>Devices</li><li>▷ Device 1 (EtherCAT)</li><li>◀ Device 2 (EL6751)<ul style="list-style-type: none"><li>▷ Image</li><li>▷ Inputs</li></ul></li><li>▷ Box 1 (CANopen Slave)</li></ul></li><li>◀ Mappings<ul style="list-style-type: none"><li>▷ NC-Task 1 SAF - Device 1 (EtherCAT) 1</li><li>▷ NC-Task 1 SAF - Device 1 (EtherCAT) Info</li></ul></li></ul></li></ul>	<ul style="list-style-type: none"><li>- Create NC Motion Task as „NC/PTP NCI Configuration“</li><li>- Add „Continuous Axis“</li></ul>



3	<p>The screenshot shows the TwinCAT Project1 interface. On the left is the Solution Explorer with a project named 'TwinCAT Project1'. The right pane is titled 'TwinCAT Project1' and shows the 'Motion' tab settings for 'Axis 1'. The 'Axis Type' is set to 'CANopen DS402/Profile MDP 742 (e.g. EtherCAT CoE Drive)'. The 'Unit' is set to 'mm'. Under 'Result', the position is set to 'mm', velocity to 'mm/s', acceleration to 'mm/s²', and jerk to 'mm/s³'. In the 'Axis Cycle Time / Access Divider' section, the divider is set to '1' and the cycle time is '2.000 ms'. The 'Modulo' field is set to '0'.</p>	<ul style="list-style-type: none"><li>- Define NC Axis as DSP402 type</li></ul>																																																																																																																																							
4	<p>The screenshot shows the TwinCAT Project1 interface. On the left is the Solution Explorer with a project named 'TwinCAT Project1'. The right pane is titled 'TwinCAT Project1' and shows the 'Parameters' tab settings for 'Axis 1'. The table lists various parameters with their offline and online values, types, and units. Key entries include Maximum Acceleration (15000.0 mm/s²), Maximum Deceleration (15000.0 mm/s²), Default Acceleration (1500.0 mm/s²), Default Deceleration (1500.0 mm/s²), Default Jerk (2250.0 mm/s³), Position Lag Monitoring (set to FALSE), and Position Range Monitoring (set to FALSE).</p> <table border="1"><thead><tr><th>Parameter</th><th>Offline Value</th><th>Online Value</th><th>Type</th><th>Unit</th></tr></thead><tbody><tr><td>Maximum Acceleration</td><td>15000.0</td><td></td><td>F</td><td>mm/s²</td></tr><tr><td>Maximum Deceleration</td><td>15000.0</td><td></td><td>F</td><td>mm/s²</td></tr><tr><td>- Default Dynamics:</td><td></td><td></td><td></td><td></td></tr><tr><td>Default Acceleration</td><td>1500.0</td><td></td><td>F</td><td>mm/s²</td></tr><tr><td>Default Deceleration</td><td>1500.0</td><td></td><td>F</td><td>mm/s²</td></tr><tr><td>Default Jerk</td><td>2250.0</td><td></td><td>F</td><td>mm/s³</td></tr><tr><td>+ Manual Motion and Homing:</td><td></td><td></td><td></td><td></td></tr><tr><td>+ Fast Axis Stop:</td><td></td><td></td><td></td><td></td></tr><tr><td>+ Limit Switches:</td><td></td><td></td><td></td><td></td></tr><tr><td>- Monitoring:</td><td></td><td></td><td></td><td></td></tr><tr><td>Position Lag Monitoring</td><td>FALSE</td><td></td><td>B</td><td></td></tr><tr><td>  Maximum Position Lag Value</td><td>5.0</td><td></td><td>F</td><td>mm</td></tr><tr><td>  Maximum Position Lag Filter Time</td><td>0.02</td><td></td><td>F</td><td>s</td></tr><tr><td>Position Range Monitoring</td><td>FALSE</td><td></td><td>B</td><td></td></tr><tr><td>  Position Range Window</td><td>5.0</td><td></td><td>F</td><td>mm</td></tr><tr><td>Target Position Monitoring</td><td>FALSE</td><td></td><td>B</td><td></td></tr><tr><td>  Target Position Window</td><td>2.0</td><td></td><td>F</td><td>mm</td></tr><tr><td>  Target Position Monitoring Time</td><td>0.02</td><td></td><td>F</td><td>s</td></tr><tr><td>In-Target Alarm</td><td>FALSE</td><td></td><td>B</td><td></td></tr><tr><td>  In-Target Timeout</td><td>5.0</td><td></td><td>F</td><td>s</td></tr><tr><td>Motion Monitoring</td><td>FALSE</td><td></td><td>B</td><td></td></tr><tr><td>  Motion Monitoring Window</td><td>0.1</td><td></td><td>F</td><td>mm</td></tr><tr><td>  Motion Monitoring Time</td><td>0.5</td><td></td><td>F</td><td>s</td></tr><tr><td>+ Setpoint Generator:</td><td></td><td></td><td></td><td></td></tr><tr><td>+ NC Parameter:</td><td></td><td></td><td></td><td></td></tr><tr><td>+ Other Settings:</td><td></td><td></td><td></td><td></td></tr></tbody></table>	Parameter	Offline Value	Online Value	Type	Unit	Maximum Acceleration	15000.0		F	mm/s²	Maximum Deceleration	15000.0		F	mm/s²	- Default Dynamics:					Default Acceleration	1500.0		F	mm/s²	Default Deceleration	1500.0		F	mm/s²	Default Jerk	2250.0		F	mm/s³	+ Manual Motion and Homing:					+ Fast Axis Stop:					+ Limit Switches:					- Monitoring:					Position Lag Monitoring	FALSE		B		Maximum Position Lag Value	5.0		F	mm	Maximum Position Lag Filter Time	0.02		F	s	Position Range Monitoring	FALSE		B		Position Range Window	5.0		F	mm	Target Position Monitoring	FALSE		B		Target Position Window	2.0		F	mm	Target Position Monitoring Time	0.02		F	s	In-Target Alarm	FALSE		B		In-Target Timeout	5.0		F	s	Motion Monitoring	FALSE		B		Motion Monitoring Window	0.1		F	mm	Motion Monitoring Time	0.5		F	s	+ Setpoint Generator:					+ NC Parameter:					+ Other Settings:					<ul style="list-style-type: none"><li>- Deactivate position lag monitoring functions</li></ul>
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5		<ul style="list-style-type: none"> <li>- Load PDO's from esi File, if necessary</li> <li>- C:\Program Files (x86)\Faulhaber\ Motion Manager 6\EDS</li> </ul>
6		<ul style="list-style-type: none"> <li>- Change Transmission Type of TxPDO2 to 1</li> </ul>
7		<ul style="list-style-type: none"> <li>- Link Statusword (TxPDO2) with Axis1_Drive nStatus1 &amp; nStatus2</li> <li>- Offset of 8 Bit is necessary</li> </ul>



**8**

Attach Variable Statusword (Input)

Search:  MOTION NC-Task 1 SAF Axes Axis 1 Enc Variable Size Mismatch

Linked Variable: nState1  
Size: 8 Offset: 0  
Linked Variable: nDataIn4  
Own Variable: 16 Overlapped: 8  
(Size and Offset in bits)

nDataIn3[1] > IB 142.0. UINT[2:0]  
nDataIn4 > IB 144.0. UINTARR2[4:0]  
nDataIn4[0] > IB 144.0. UINT[2:0]  
nDataIn4[1] > IB 146.0. UINT[2:0]  
nDataIn5 > IB 148.0. UINTARR2[4:0]  
nDataIn5[0] > IB 148.0. UINT[2:0]  
nDataIn5[1] > IB 150.0. UINT[2:0]

OK Cancel Show Dialog Variable Name / Comment / Hand over / Take over Cancel OK

Attach Variable Statusword (Input)

Search:  MOTION NC-Task 1 SAF Axes Axis 1 Enc Variable Size Mismatch

Linked Variable: nState2  
Size: 8 Offset: 0  
Linked Variable: nDataIn4  
Own Variable: 16 Overlapped: 8  
(Size and Offset in bits)

nDataIn3[1] > IB 142.0. UINT[2:0]  
nDataIn4 > IB 144.0. UINTARR2[4:0]  
nDataIn4[0] > IB 144.0. UINT[2:0]  
nDataIn4[1] > IB 146.0. UINT[2:0]  
nDataIn5 > IB 148.0. UINTARR2[4:0]  
nDataIn5[0] > IB 148.0. UINT[2:0]  
nDataIn5[1] > IB 150.0. UINT[2:0]

OK Cancel Show Dialog Variable Name / Comment / Hand over / Take over Cancel OK

**I/O Devices**

- Device 1 (EtherCAT)
- Device 2 (EL7651)
  - Image
  - Inputs
  - Outputs
- Box 1 (CANopen Slave)
  - Inputs
  - Outputs
  - TxPDO 1
    - Inputs
    - Statusword
  - TxPDO 2
    - Inputs
    - Statusword
  - RxPDO 1
    - Outputs
    - Controlword
  - RxPDO 2
    - Outputs
    - Controlword
    - Target position
  - RxPDO 3
  - RxPDO 4
  - RxPDO 1
  - RxPDO 2
  - RxPDO 3
  - RxPDO 4

Position actual value

Attach Variable Position actual value (Input)

Search:  MOTION NC-Task 1 SAF Axes Axis 1 Enc In > IB 128.0. MC\_NCODENDERSTRUCT\_IN2B[40:0]

nDataIn1 > IB 128.0. UINTARR2[4:0]
 

- nDataIn1[0] > IB 128.0. UINT[2:0]
- nDataIn1[1] > IB 130.0. UINT[2:0]

nDataIn2 > IB 132.0. UINTARR2[4:0]
 

- nDataIn2[0] > IB 132.0. UINT[2:0]
- nDataIn2[1] > IB 134.0. UINT[2:0]

nState3 > IB 138.0. USINT[1:0]
 

- nState3[0] > IB 139.0. USINT[1:0]

nDataIn3 > IB 140.0. UINTARR2[4:0]
 

- nDataIn3[0] > IB 140.0. UINT[2:0]
- nDataIn3[1] > IB 142.0. UINT[2:0]

nDataIn4 > IB 144.0. UINTARR2[4:0]
 

- nDataIn4[0] > IB 144.0. UINT[2:0]
- nDataIn4[1] > IB 146.0. UINT[2:0]

nDataIn5 > IB 148.0. UINTARR2[4:0]
 

- nDataIn5[0] > IB 148.0. UINT[2:0]
- nDataIn5[1] > IB 150.0. UINT[2:0]

nDataIn6 > IB 152.0. UINTARR2[4:0]
 

- nDataIn6[0] > IB 152.0. UINT[2:0]

Show Variables: Unused, Used and unused, Exclude disabled, Exclude other Devices, Exclude same Image, Show Tooltips, Sort by Address, Matching Type, Matching Size, All Types, Array Mode, Continuous, Show Dialog, Variable Name / Comment, Hand over, Take over.

OK Cancel Error List

**Link Position actual value (TxPDO2) to Address 1\_Enc nInData1**

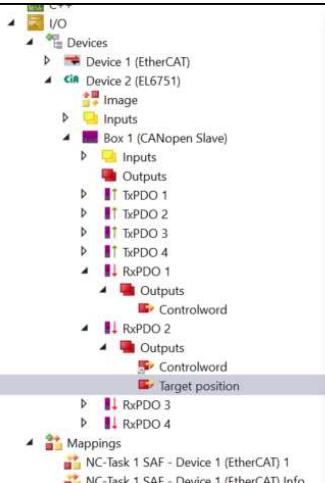
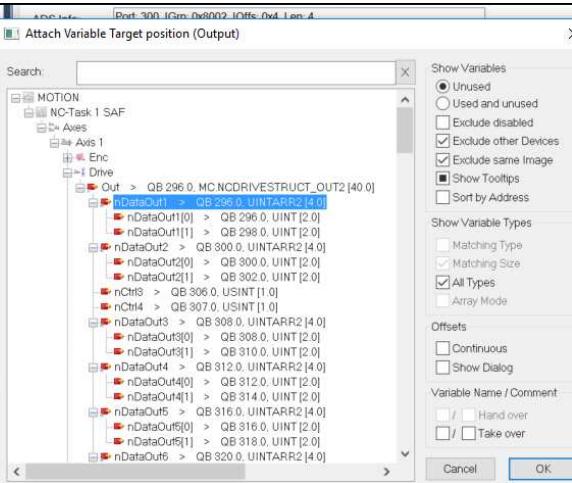
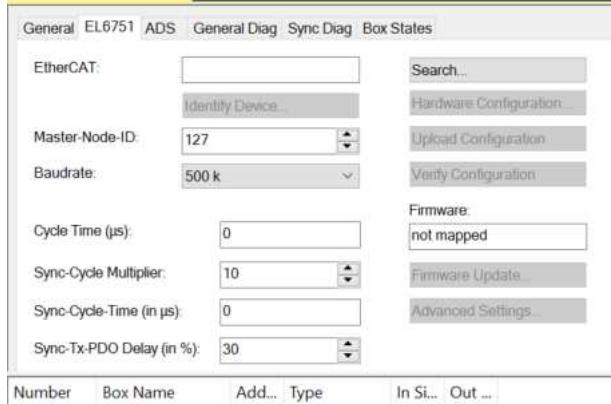
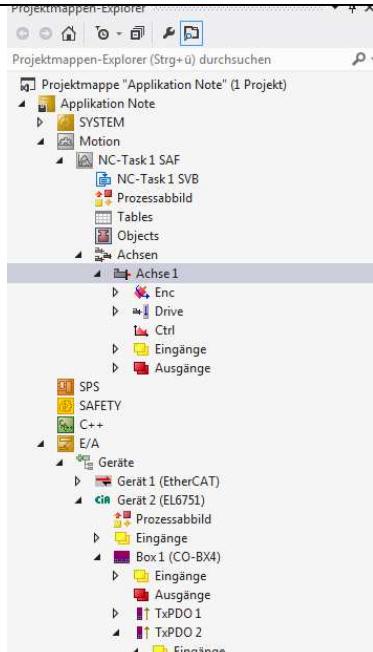
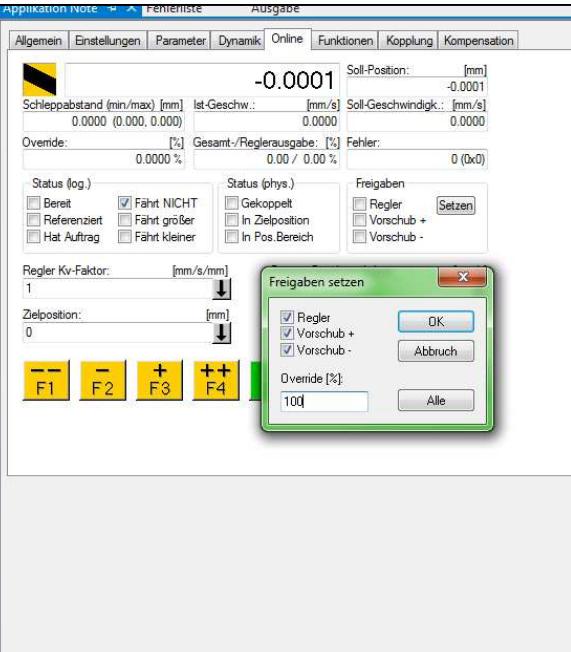


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The screenshot shows a software interface for device configuration. On the left, a tree view lists various components: I/O Devices (Device 1 (EtherCAT), Device 2 (EL6751), Image, Box 1 (CANopen Slave)), Inputs, Outputs, TxPDO 1-4, RxPDO 1-4, and Mappings (NC-Task 1 SAF - Device 1 (EtherCAT) 1, NC-Task 1 SAF - Device 1 (EtherCAT) Info). A context menu is open over the 'Controlword' entry under RxPDO 1, showing options like 'Link Controlword (RxPDO2) to Achse1\_Drive nCtrl1 & nCtrl2' and 'Offset of 8 Bit is necessary'. The main window displays a 'Attach Variable Controlword (Output)' dialog for the 'MOTION' task. The dialog lists variables for Axis 1, including 'nCtrl1' and 'nCtrl2', with their sizes (8 bits) and offsets (0) selected. Other variables listed include nDataOut1 through nDataOut5, each mapped to specific addresses like QB 296.0 to QB 316.0.

- Link Controlword (RxPDO2) to Achse1\_Drive nCtrl1 & nCtrl2

- Offset of 8 Bit is necessary

10	 	<ul style="list-style-type: none"> <li>- Link Target Position (RxPDO2) to Achse 1_Drive nOutData1</li> </ul>
11		<ul style="list-style-type: none"> <li>- Set Synch-Cycle Multiplier to 10</li> </ul>
12		<ul style="list-style-type: none"> <li>- Activate configuration and run the PLC</li> </ul>
13	 	<ul style="list-style-type: none"> <li>- Enable the NC Drive</li> </ul>



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- After the drive is enabled reset the NC axis with F(, then activate the NC axis with F5
- From that point on it is possible to run the motor with F1 – F4

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