Commissioning a Beckhoff Axis

How to test the function of a Beckhoff axis during commissioning

| 🕑 Difficulty **Medium** | 🕐 Duration **2 hour(s)** |

Contents

Introduction

✋ ...Any stepper motor drives will need the EP7041 drive to be programmed first

Step 1 - Set any stepper motor drives

Any stepper drives connected using an EP7041 will need to be set up according to the procedure.

Step 2 - Check Axis IDs

Ensure the axis.mul file is set up with the same axis Ids as the TwinCAT project
Second number in axes.mul file

Step 3 - Software

The following software setup needs to be done
- TwinCAT project setup with all io and axes linked
- Estop system reset
- Air on
- winMulti running in setup mode

Step 4 - Ensure axis is enabled

- All 3 Enable signals
- 100% Override
- Axis Ready

Step 5 - Set Rough Absolute position

On the functions tab, set the absolute position by eye.
This ensures the axis is in the correct place for test positioning
** Diagram for axis directions and distances **

Step 6 - Check Axis Direction - move slowly and short distance

X and SX axis - positive is out of machine towards outfeed
Y axis - positive towards rear
Z axis - positive is up
V axis - positive is towards rear
R axis - positive is rotation downwards when looking from front of machine
SR Axis - positive is always anticlockwise looking from top
SY Axis - positive is towards the front of the saw

Relative move on axis slowly plus and minus to test direction
Direction changed in axes.mul, the parameter after the scaling factor

> ⚠ ...Exit winmulti before changing direction in axes.mul. Save axes.mul then restart WinMulti

Step 7 - Check Scaling

There is a possibility that the scaling factor could be different on the machine. this depends on how similar the setup was on the machine that the axes.mul was copied from.
Changes in gearboxes or motors will affect the scaling factor#

Simply mark the axis, move it a known distance and ensure it is correct.
Scaling changed using the formula

new scaling factor = old scaling * distance moved / distance required

Step 8 - Ensure the movement is clear

- X and SX - No tools left in track overnight
- Z axis supports removed and air balanced
- V - X axis beam outside the machining centre

Step 9 - Reversing move - High Speed

Reversing move on axis.
Set speed to the maximum for each axis
Target positions to stay well within the limitations (you have only guessed the actual position)

Step 10 - Move all axes in reversing mode

Shakedown to ensure all axes move smoothly at full speed

Step 11 - Set the drive special parameters

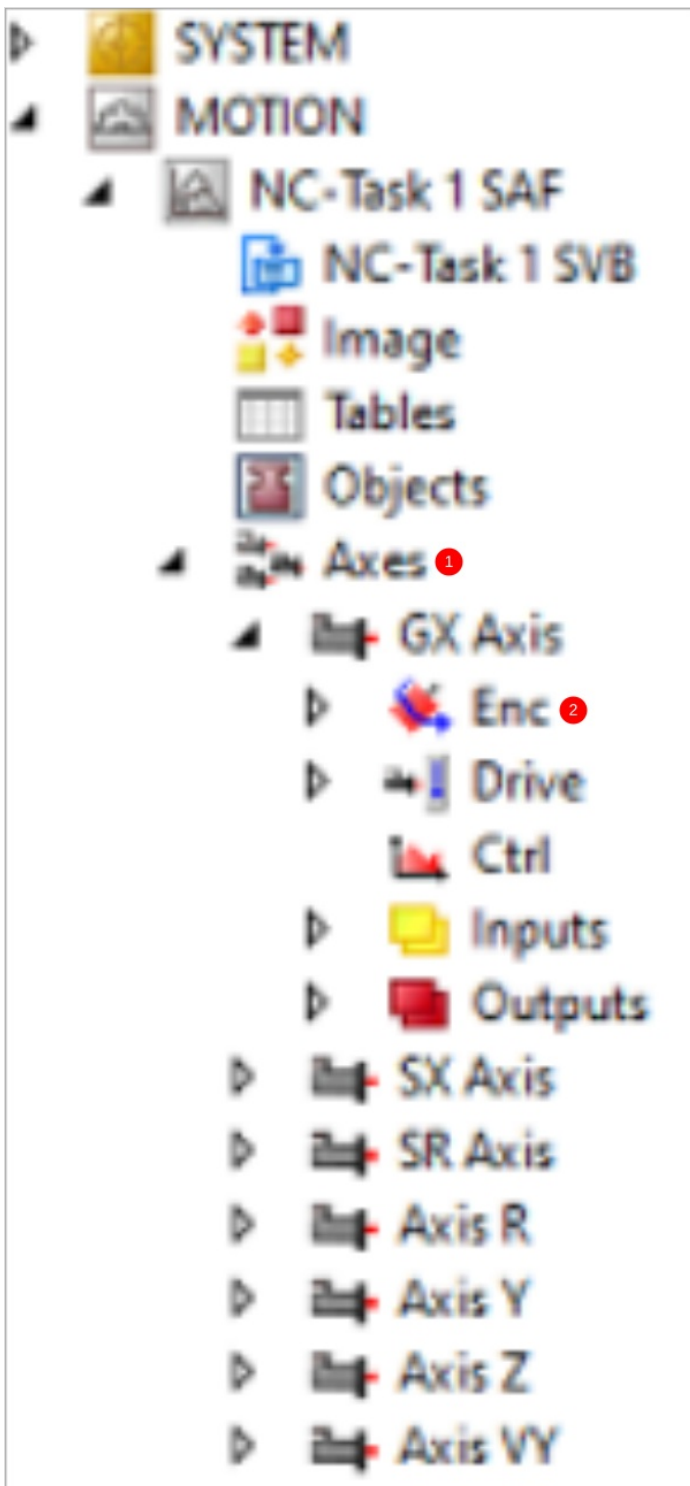https://stuga.dokit.app/wiki/Specialised_Settings_for_Beckhoff_Drives

Step 12 - Test Datum Direction

- By hand, move every axis to roughly the middle of its possible travel or at least off the datum switch. **This does not apply to the V axis on a ZX5 which works in reverse i.e the axis is 'home' when the switch is not made.**
- In the drives tab on the service screen in WinMulti press 'Home' on the first axis. Keep a close eye on the direction of travel. If it is travelling away from the datum switch then it is moving in the wrong direction and needs to be stopped quickly.
- Repeat for the rest of the axes in turn. Wait for one axis to finish before starting another one.
- Make a note of which axes are homing in the wrong direction. These will need to be changed in the TwinCAT project.

Step 13 - Changing the Datum Direction

- Close WinMulti and open the TwinCAT project.
- In the Motion tab in the TwinCAT project navigate to the Axes tab (1).
- Refer to the list you made earlier of the axes that are datuming in the wrong direction. Select the first axis that was wrong and navigate to the 'Enc' tab (2).
- Open the Parameters tab (3) and scroll down to 'Homing' (4)
- There are two parameters in there called 'Invert Direction for Calibration Cam Search' and 'Invert Direction for Sync Inputs Search'
- In order to change the homing direction 'Invert Direction for Calibration Cam Search' needs to be swapped from True to False or from False to True depending on what it is already on.
- In order to change it, use the drop down menu in the 'Offline value' column. When changed, the 'Online value' will change and turn red. Click download to turn it blue again.
- Whatever 'Invert Direction for Calibration Cam Search' is, 'Invert Direction for Sync Inputs Search' needs to be the opposite. Otherwise, the axis will continue to move in the same direction once the switch is made.

> ⓘ ...More than one parameter cannot be changed at the same time so change one, click 'Dowload' then change another and click 'Dowload' again.

Parameter	Offline Value		Online Value	Unit
Encoder Evaluation:				
Invert Encoder Counting Direction	FALSE	▼	TRUE	
Scaling Factor Numerator	0.0001		0.000030555175605	mm/INC
Scaling Factor Denominator (default: 1.0)	1.0		1.0	
Position Bias	0.0		0.0	mm
Modulo Factor (e.g. 360.0°)	360.0		360.0	mm
Tolerance Window for Modulo Start	0.0		0.0	mm
Encoder Mask (maximum encoder value)	0xFFFFFFFF		0xFFFFFFFF	
Encoder Sub Mask (absolute range maximum value)	0x000FFFFF		0x000FFFFF	
Reference System	'INCREMENTAL'	▼	'INCREMENTAL'	
Limit Switches:				
Soft Position Limit Minimum Monitoring	FALSE	▼	TRUE	
Minimum Position	0.0		-100.0	mm
Soft Position Limit Maximum Monitoring	FALSE	▼	TRUE	
Maximum Position	0.0		7700.0	mm
Filter:				
Homing:				
Invert Direction for Calibration Cam Search	TRUE	▼	TRUE	
Invert Direction for Sync Impuls Search	FALSE	▼	FALSE	
Calibration Value	0.0		392.0	mm
Reference Mode	'Software Sync'	▼	'Software Sync'	
Other Settings:				

Step 14 - Changing Reference Mode

- When using a Beckhoff system the GX, Y, Z, SX and SR Axes need to be set to 'Software Sync'. This is a more accurate method of datuming, meaning that the datum will be more consistent as when set to other reference methods, the datum can change by up to 10mm depending on the physical position of the datum switch.
- To change this, stay in the same 'Parameters' tab in the 'Homing' section and follow the same process as above, this time changing the 'Reference mode' (1) to 'Software Sync'.
- Repeat for all the above axes
- Save all' and 'Activate configuration'.
- Reopen WinMulti and test the homing directions again to double check.

General | NC-Encoder | Parameter | Sercos | Time Compensation | Online

Parameter	Offline Value	Online Value	Unit
Encoder Evaluation:			
Invert Encoder Counting Direction	FALSE	TRUE	
Scaling Factor Numerator	0.0001	0.000030555175605	mm/INC
Scaling Factor Denominator (default: 1.0)	1.0	1.0	
Position Bias	0.0	0.0	mm
Modulo Factor (e.g. 360.0°)	360.0	360.0	mm
Tolerance Window for Modulo Start	0.0	0.0	mm
Encoder Mask (maximum encoder value)	0xFFFFFFFF	0xFFFFFFFF	
Encoder Sub Mask (absolute range maximum value)	0x000FFFFF	0x000FFFFF	
Reference System	'INCREMENTAL'	'INCREMENTAL'	
Limit Switches:			
Soft Position Limit Minimum Monitoring	FALSE	TRUE	
Minimum Position	0.0	-100.0	mm
Soft Position Limit Maximum Monitoring	FALSE	TRUE	
Maximum Position	0.0	7700.0	mm
Filter:			
Homing:			
Invert Direction for Calibration Cam Search	TRUE	TRUE	
Invert Direction for Sync Impuls Search	FALSE	FALSE	
Calibration Value	0.0	392.0	mm
Reference Mode	'Software Sync'	'Software Sync'	
Other Settings:			