Service Instructions
System MSP - DSF
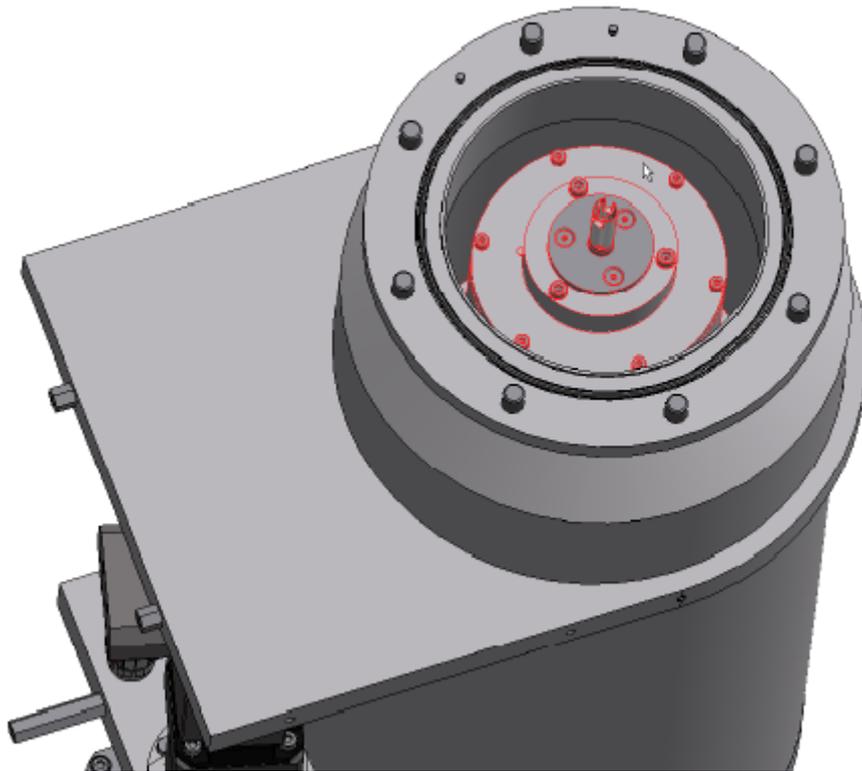
Revision History:

| Revision	Date	BY	Description
1	20.12.2017	MOR	Initial Revision
1.1	26.01.2018	MOR / MeAnd	Ch.4: Caution Ch. 4.6.2: Laser positioning Ch.4.6.6: added Ch. 4.7.1: Description added Ex Ch. 5.1/5.2: deleted Ch. 5.1: Description to "Circle of Flip" added

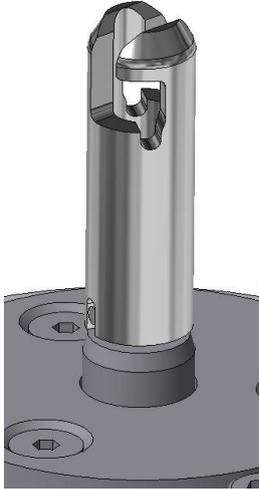## Content

1 System configuration

1.1 Introduction

The MSP with DSF is able to flip all segments within 15 minutes. This allows a double side coating of the segments and increases the throughput of the system.
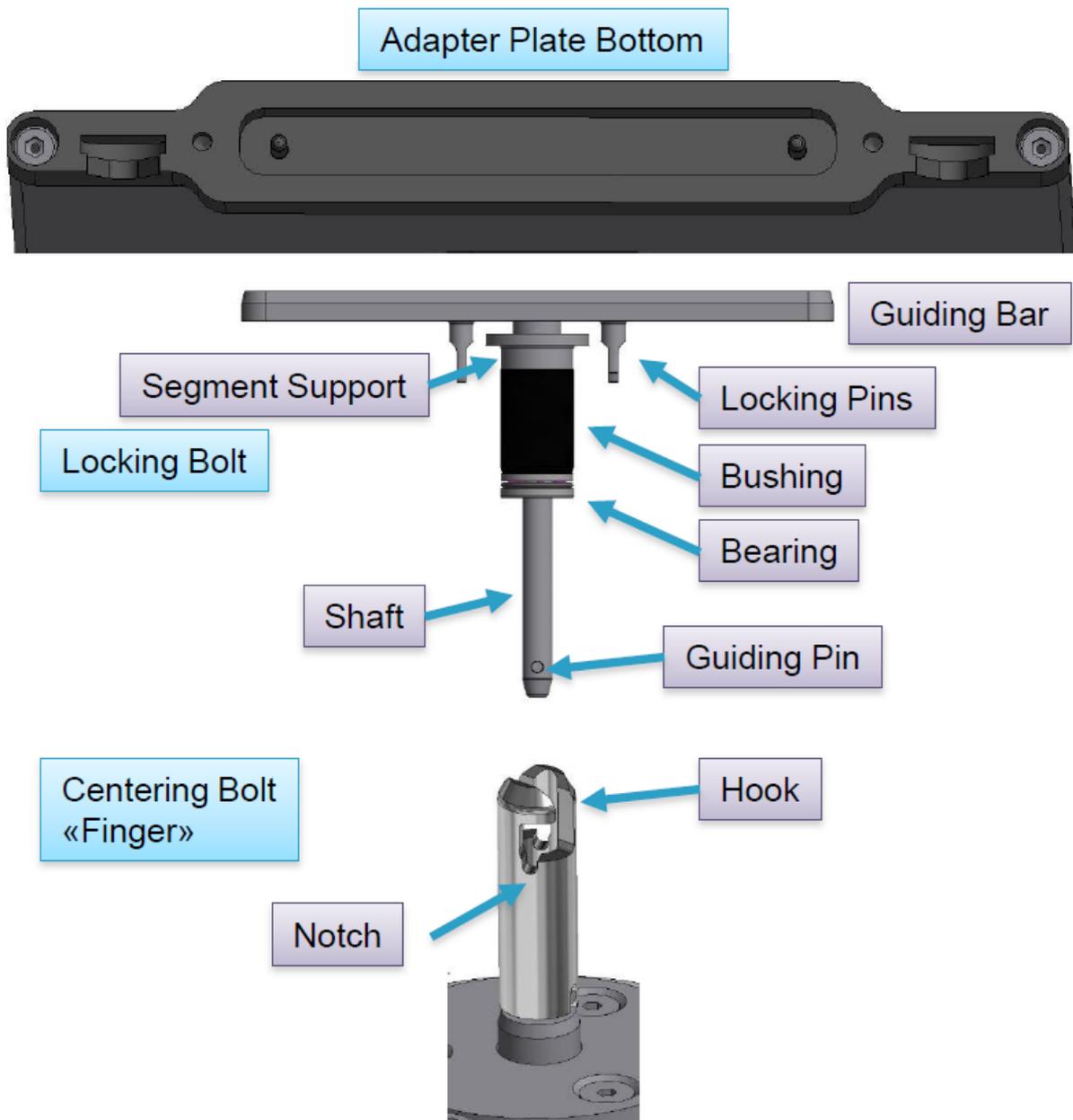
2 Components of flipping mechanism

2.1 Centering Bolt (Flip Finger) 1.1

The Centering Bolt (Flip Finger) is mounted on the motors for the height and turn movement. Consisting of a high quality vacuum polymer with a low friction value. It is designed to be the weak point if an accident in the movement happens and should break to prevent damage to other components of the system.

2.2 Locking Bolt 1.1

The Locking Bolt has many different functions. It carries the weight of the segment and includes a bearing for a smooth rotation. It contains two locking pins for the fixtation on a certain rotation position, so that the substrates will stay in position. It is moveable in the z-direction. These parts can easily be damaged by a wrong segment handling due to operation.

2.3 Segment 1.1

The segments have a slit for the insertion of the locking bolts. It serves as a guiding and covering while coating happens.
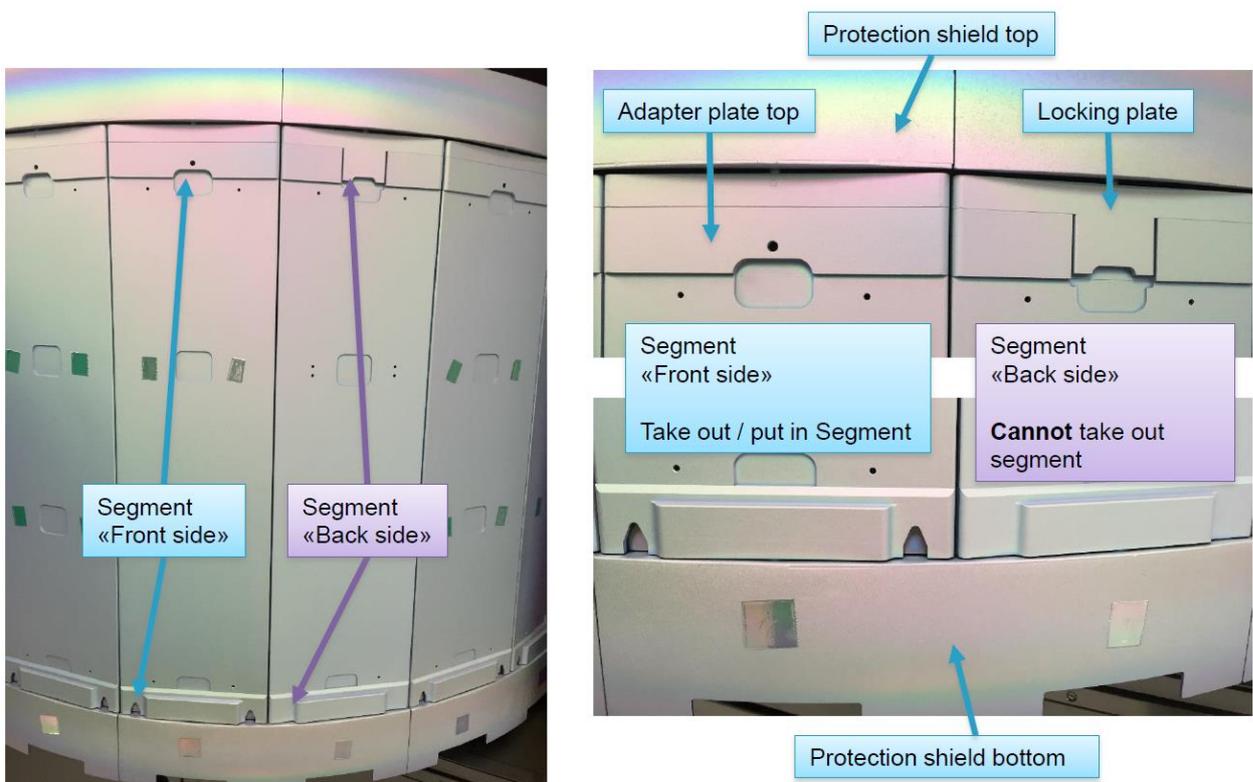
3 Flip Routine

The whole flip routine consists of many different steps which are shown in the following table.

Action	Pos Lift [mm]	Pos ST [°]
Start Flip	-100	0
Shutter Home	-100	0
Drum position	-100	0
Wait position	-8	0
Lock height	16	0
Lock turn	16	60
Flip height	28	60
Flip rotation	28	240
Segment lock	14	240
release	15	240
unlock	15	180
Wait position	-8	180
Rotation Home	-8	0

The DSF Rotation Lock angle has to be verified on each tool.

4 Xenus/Drum Drive Parameter configuration

Caution: Manual operation of the single axes needs to be performed with great care! Wrong settings or wrong teaching may lead to collision and damage of parts.

4.1 StartUp Xenus Drives

StartUp Xenus Drives → Khan Config → Homing DSF Height → Homing Drum → Homing DSF Rotation

4.1.1 DSF Height Configuration and Phasing

**Remove Flip Height Drive from the gear for the first startup!**

Drive:PL-230-18
Motor: SME60..F4 (Endat – Absolut Multiturn)

1. Connect your Notebook with the Xenus drive (serial line RS232). You have to unplug it from the Moxa in the electrical cabinet.
2. Choose the correct serial line
3. Update the Xenus drive with the actual Flip drive parameter file.
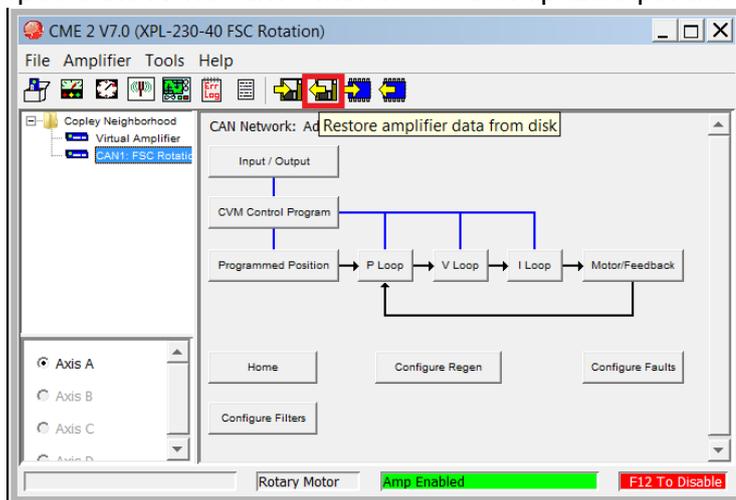
4. After loading the actual drive parameter, save the parameters on the flash memory of the drive.
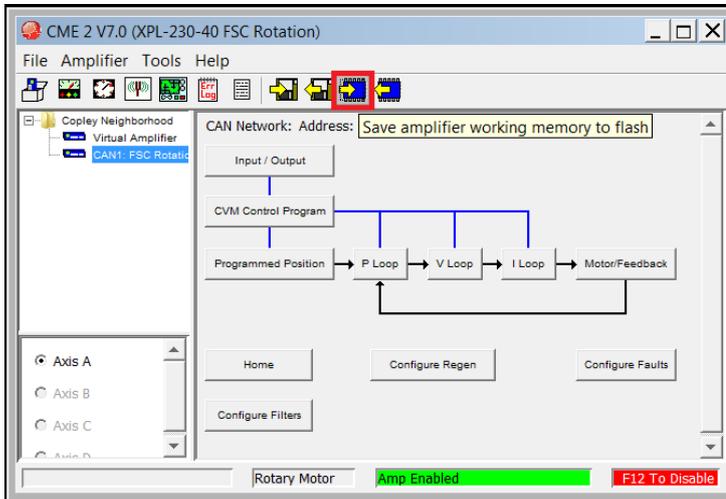
➔ So the parameters are saved to the flash memory

5. Disconnect the 24V power supply from the XENUS and reconnect it again. After that you can connect the drive via Can bus during the Khan software is running (connect the serial line back to the Moxa).

6. CME2 tries to connect with the serial line connection, so the error message is right.
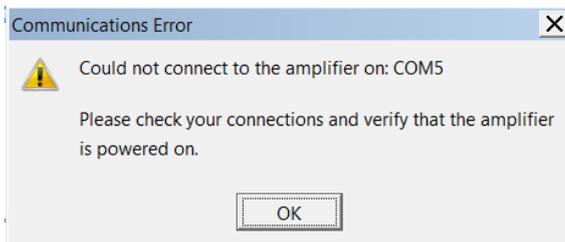
7. Open the communication wizard again and change the settings to CAN Network.
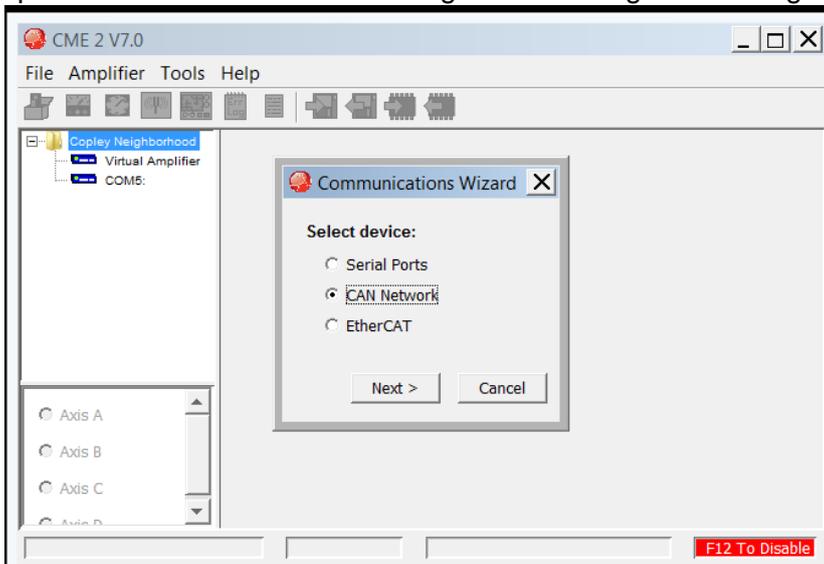
8. Bit Rate 1Mbit/s should be fine, click Finish.
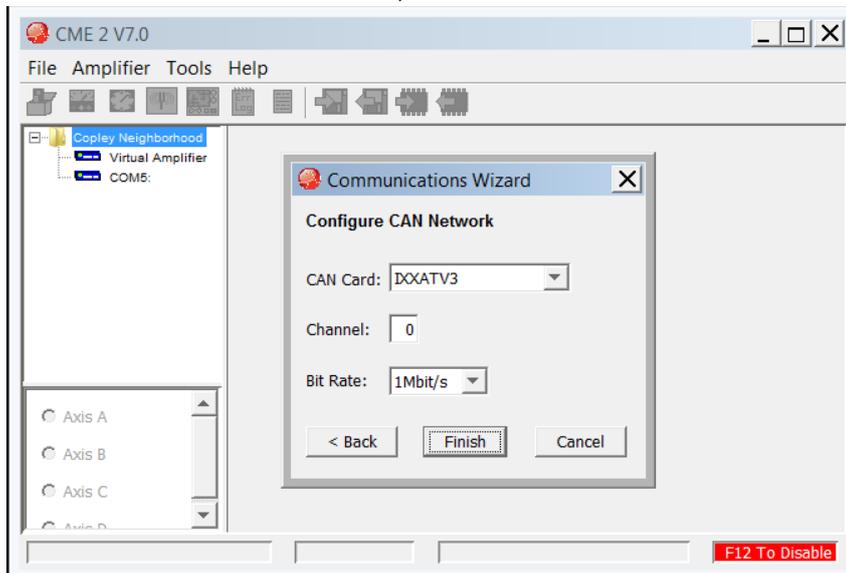
9. Open the control panel. On the control panel you can enable/disable the drive or check the error messages.

10. Now check the Manual Phase to verify the motor output and feedback. Click Tool →
    Manual Phase.

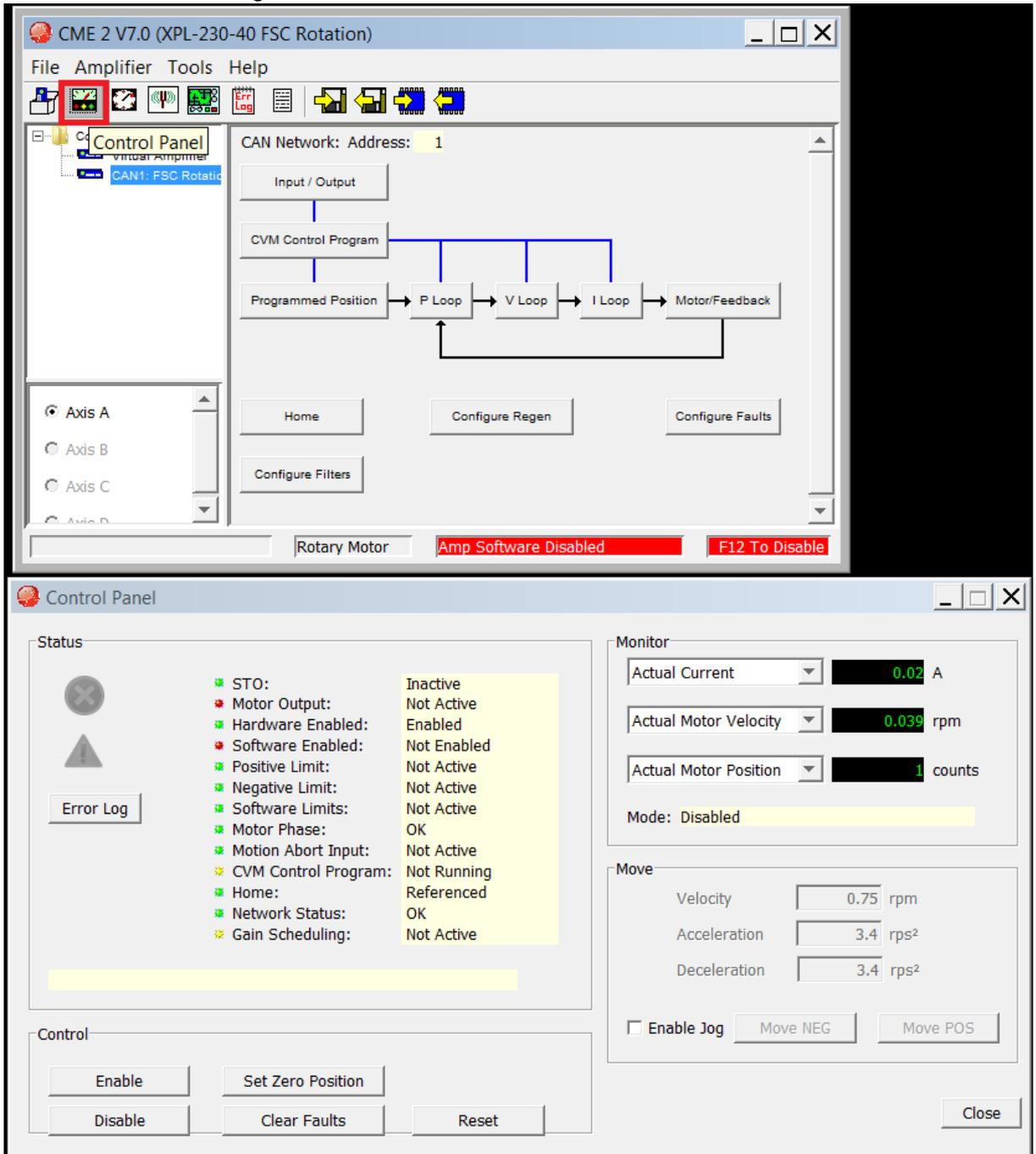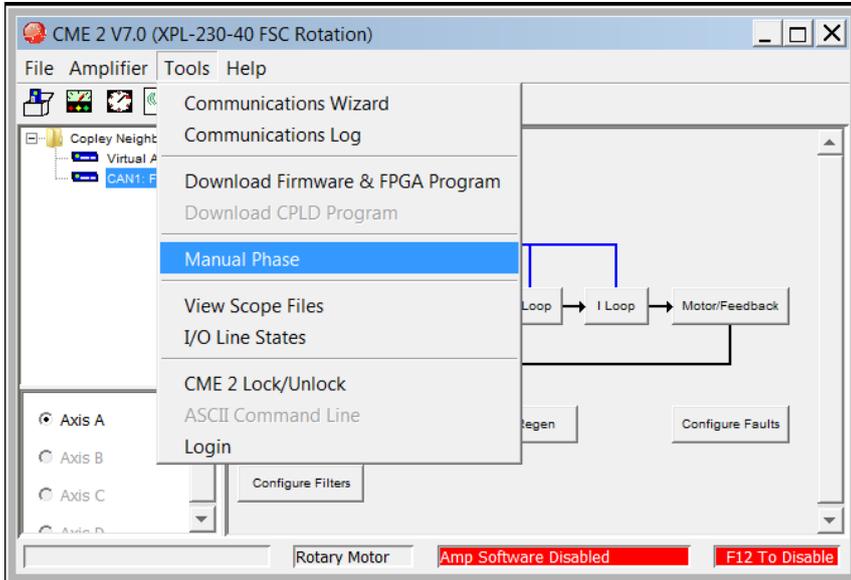11. First set the current to 0.5A (drive is still removed from the gear). Second step, enable
    the drive and click "forward/reverse" to check on point 4. If the gap is small. The red
    pointer should be just behind the black one. **Disable the Drive Motor Invert Output**
    casket.
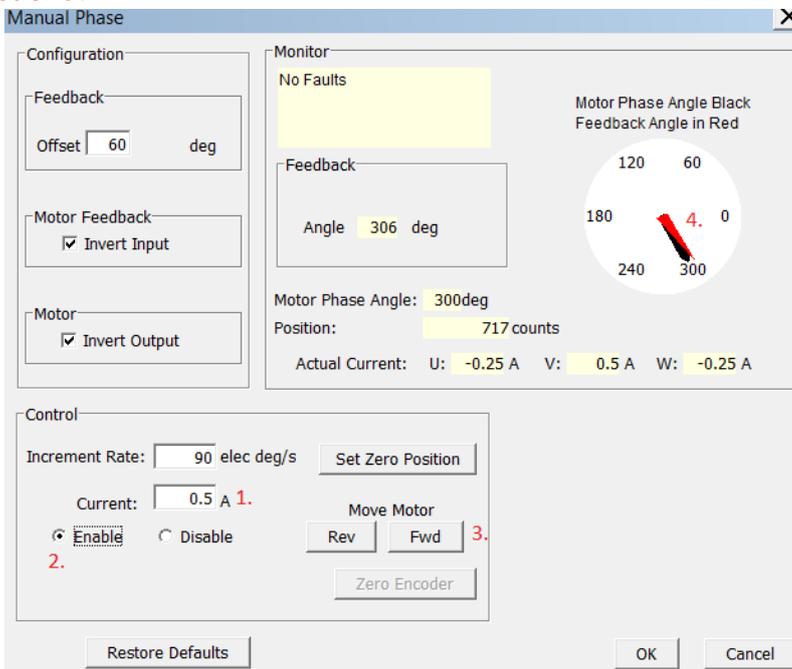
12. Open the control panel and click „enable".
13. Now you can jog in the positive and negative direction. The negative direction should
    be the down direction.
14. Reassemble the drive to the gear again and start with the homing.

4.1.2 DSF Rotation Configuration and Phasing

1. Drive stays on the gear, because there is no issue if the drive moves
2. Connect the same way you did for the Height Drive (first serial line)
3. Load the actual Flip Rotation parameters
4. Reconnect 24V from the Xenus Rotation drive
5. Connect the serial line back to the Moxa and connect your Notebook via CAN to the drive.
6. Check Manual Phase
7. Enable the drive in the control panel and check if the drive is working smoothly.
8. Jog with the drive to verify the motion is fine
9. Insert the Dummy Locking Bolt into the drum to Home the drive

4.2 DSF Khan Configuration

4.2.1 Drum

In the EtherCAT configuration the Controller S700 for the Drum rotation must be configured.
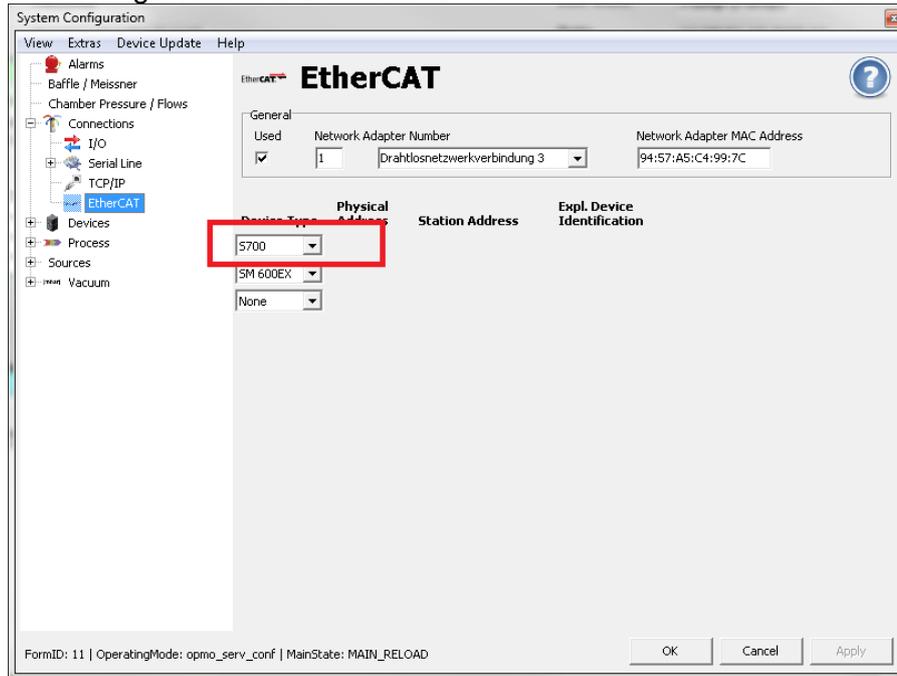
In the Rotation configuration two parameters must be set, the Gear Ratio und Velocity. See on the screenshot below:
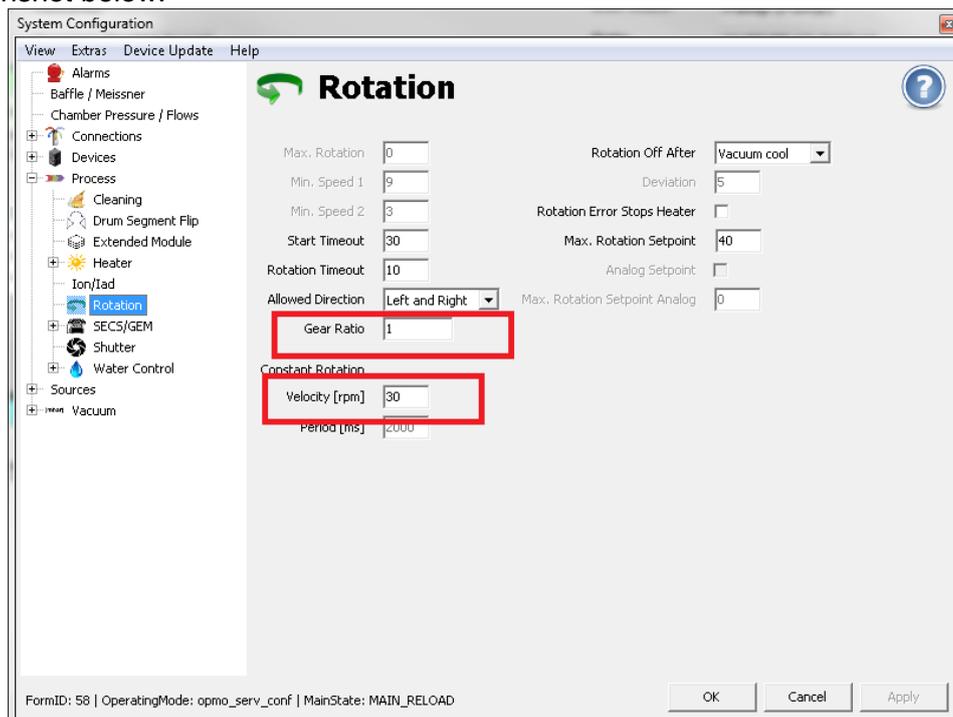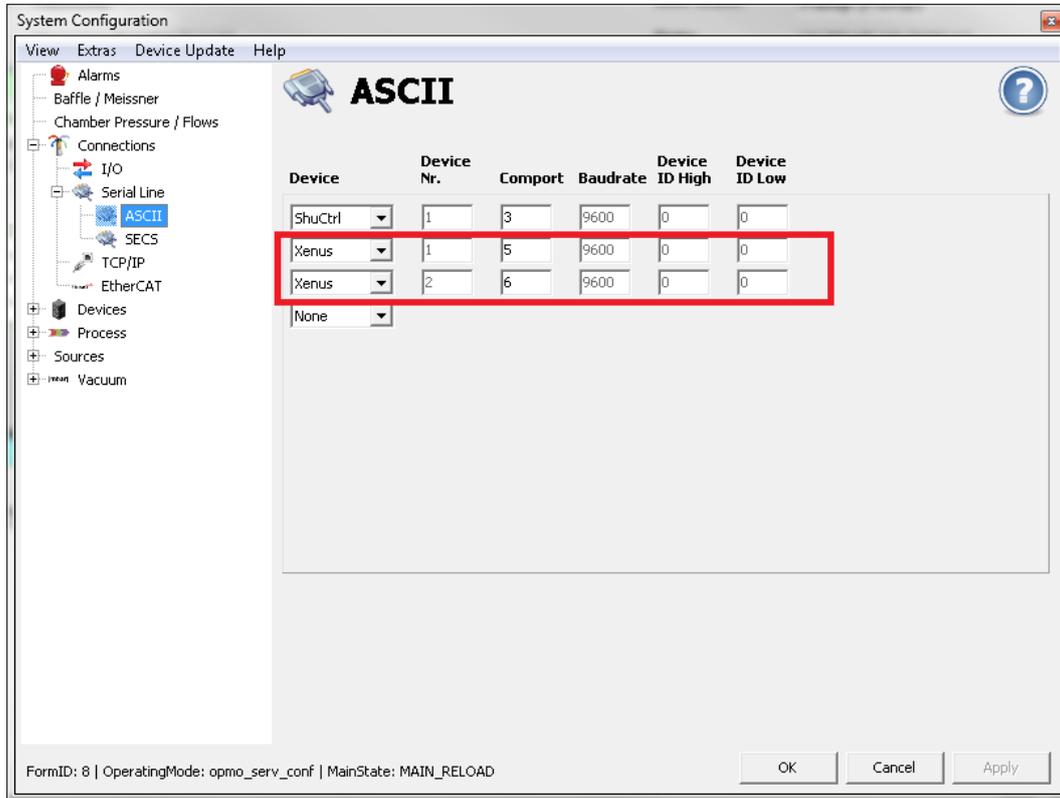
4.2.2 Flip-Drives

The Xenus-Controller must be configured in the Serial Line Configuration. The important thing is the configuration of the correct com port.

- Device Nr. 1 is for the height drive
- Device Nr. 2 is for the rotation drive

After the Khan configuration the Khan must be closed. After that the System File (C:\PCB32\Conf\System.conf) has to be adjusted.

Open the C:\PCB32\Conf\System.conf with the Text editor and search the word „Xenus Drive Ctrl". Modify the following parameters (Counts per Revolution, Gear Ratio, Low Limit and High Limit) like in the picture below:

```
    },
    "Xenus Drive Ctrl":[
      {
        "Identification":{
          "Number":1
        },
        "Parameter":{
          "Timeout":180,
          "Counts Per Revolution":65536,
          "Gear Ratio":0.8,
          "Low Limit":-110,
          "High Limit":30,
          "Offset":0,
          "Inverse Modtion":false
        }
      },
      {
        "Identification":{
          "Number":2
        },
        "Parameter":{
          "Timeout":180,
          "Counts Per Revolution":65536,
          "Gear Ratio":3,
          "Low Limit":0,
          "High Limit":360,
          "Offset":0,
          "Inverse Modtion":false
        }
      }
    ]
    },
```

4.2.3 Feature configuration

In the Configuration page F10 (Menu) / Configuration / System Configuration the Flipper can be activated. The main page also includes the amount of segments used for the determination of the degree value to drive for the drum rotation positioning and the supervision limitation values.
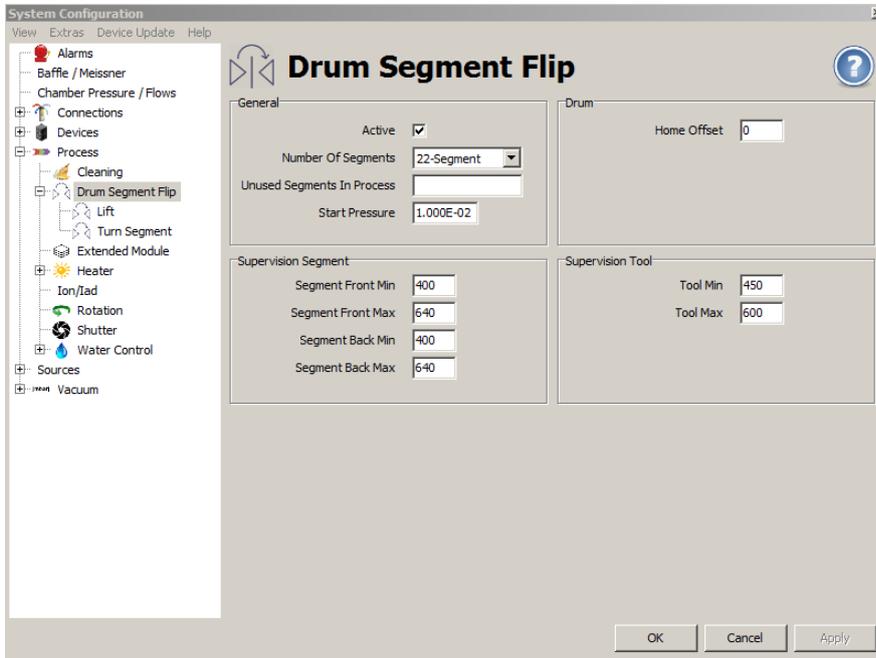
After that, the device ctrl number and several handling parameter must be configured.

For the DSF Height 1.1 (22.09.2017) following parameters will be set:
The DSF Height is always device number 1.
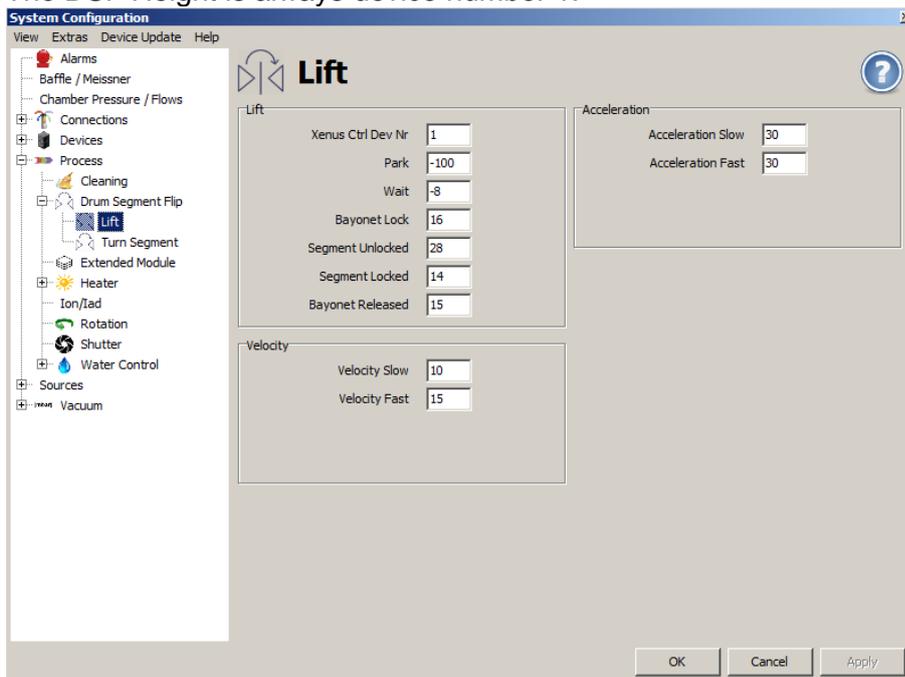
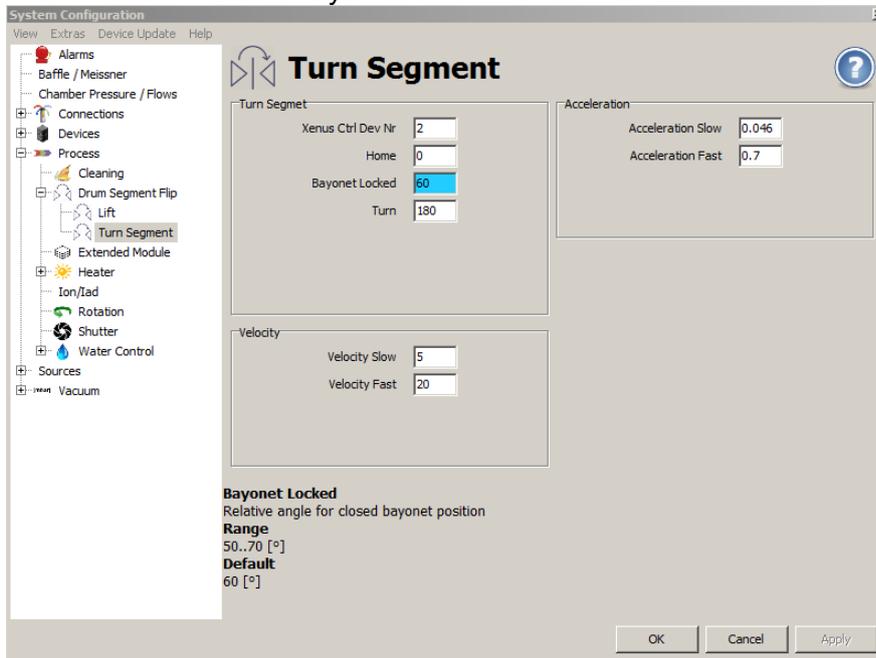**For the DSF Rotation 1.1 (22.09.2017) following parameters will be set:**
The DSF rotation is always device number 2.

Attention: Bayonet Locked will vary on every tool and has to be verified. (57-63°)

4.3 Flip Height Homing (Centering bolt touches the drum)

Important: Homing routine must be done in vacuum!
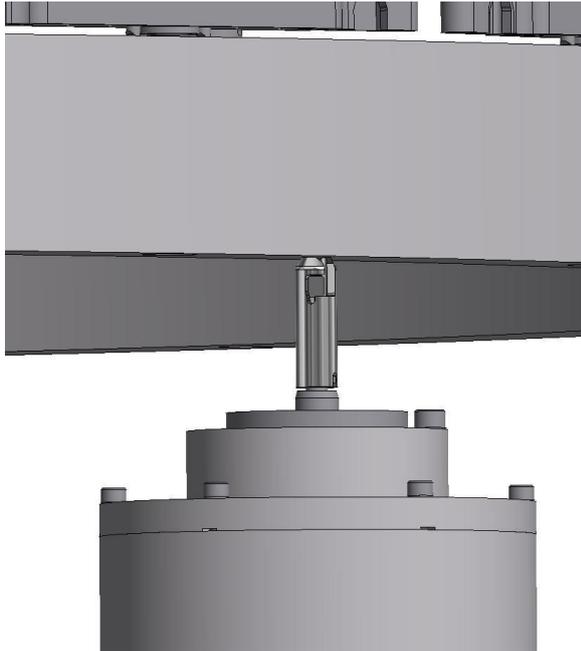
Remove shielding to see the drum

1. Open the control panel

2. In the Jog-Mode move slowly positive until the Centering Bolt (Flip Finger) touches the drum.

3. Disable Jog Mode (IMPORTANT)
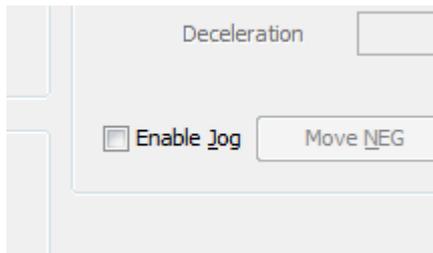
4. Open the HOME Panel
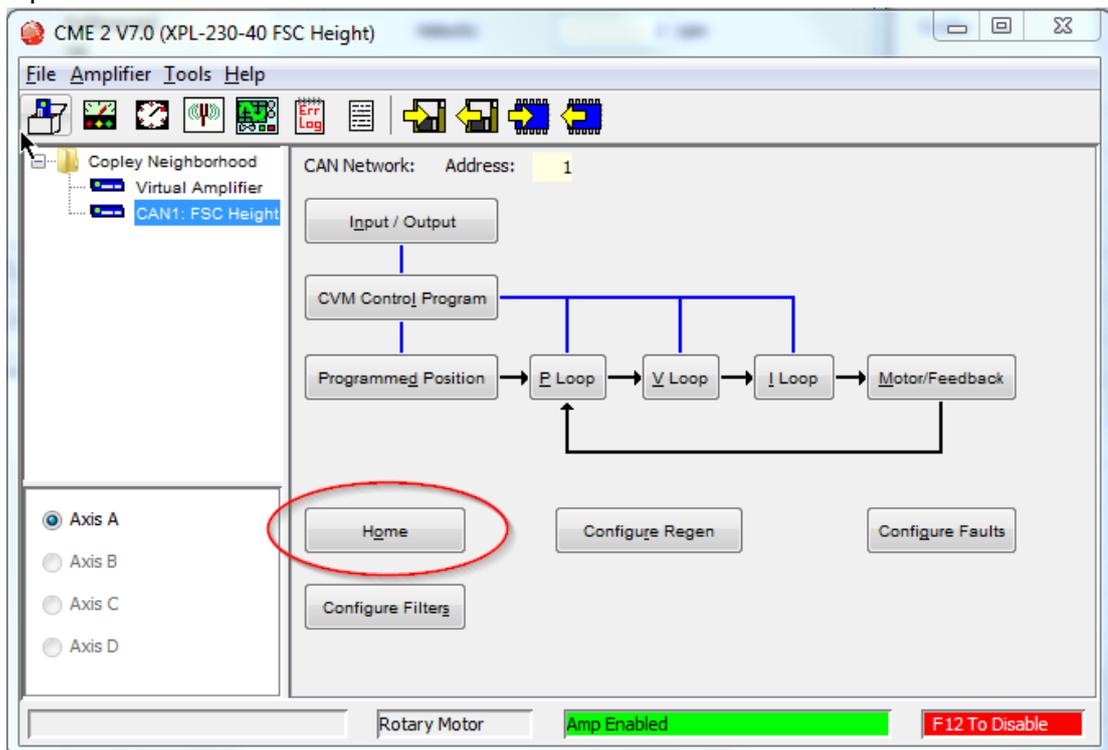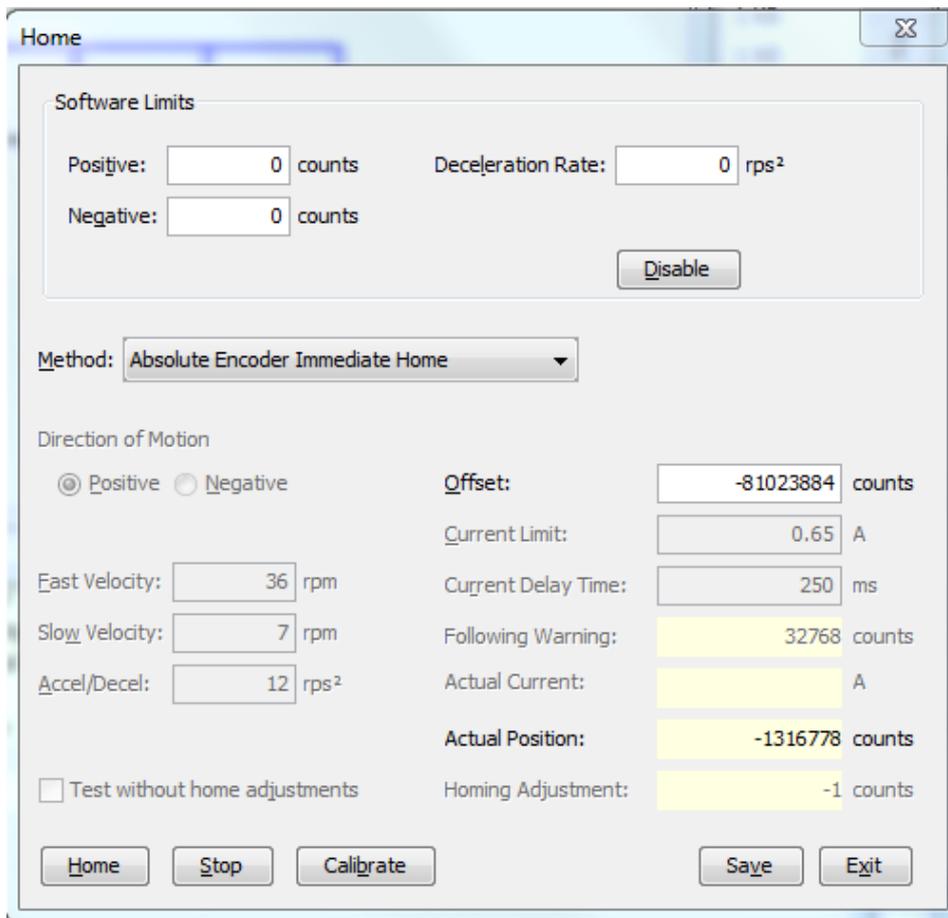
5. Choose Homing Method: „Set current position as Home"

6. Set Offset „0"
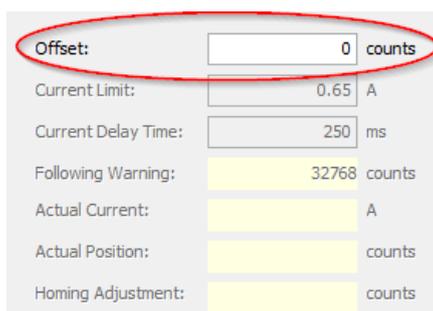
7. Click HOME Button

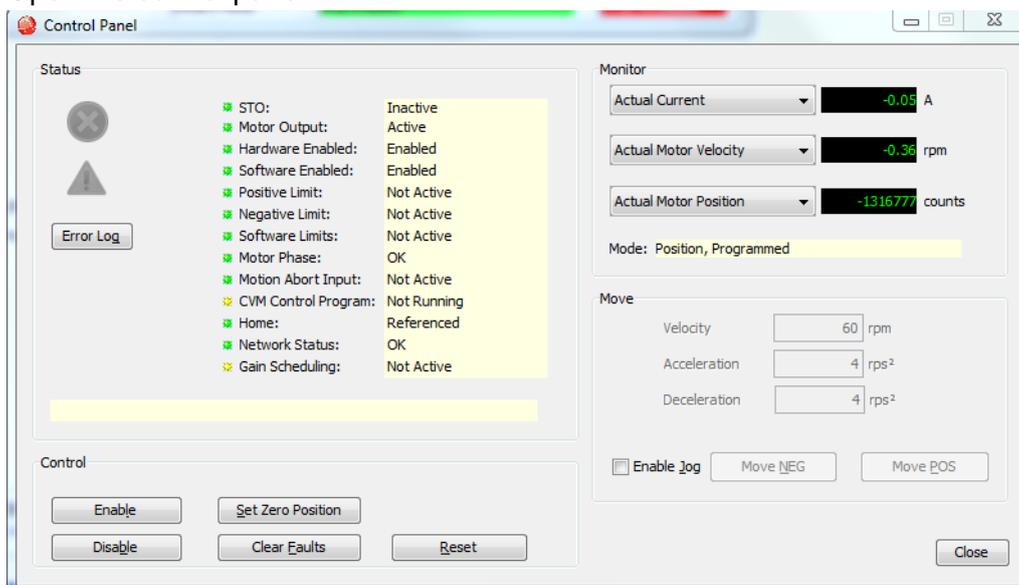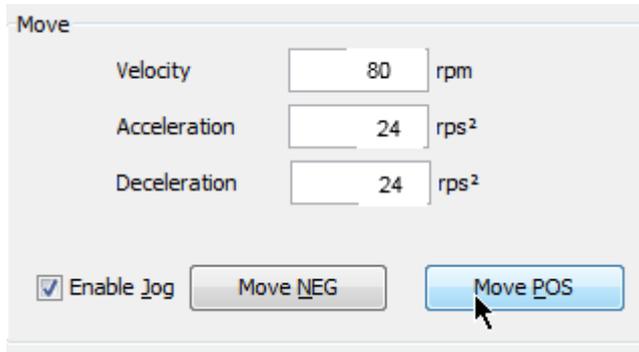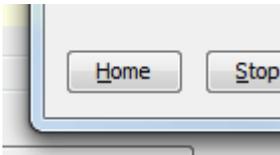➔ **wait until the „Homing complete" message pops up. ➔ Click OK**

8. Click CALIBRATE Button
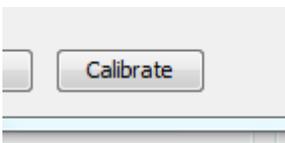
➔ **wait until the Actual Position is 0 counts**

Offset:	0	counts
Current Limit:	0.65	A
Current Delay Time:	250	ms
Following Warning:	32768	counts
Actual Current:		A
Actual Position:	0	counts
Homing Adjustment:		counts
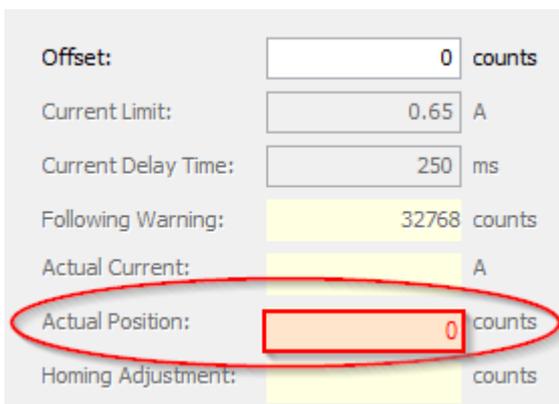
9. Click SAVE, then EXIT

10. Save the configuration to the flash memory of the Xenus drive
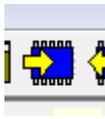
11. Save the configuration file on your Notebook as a BackUp

12. Open Control Panel
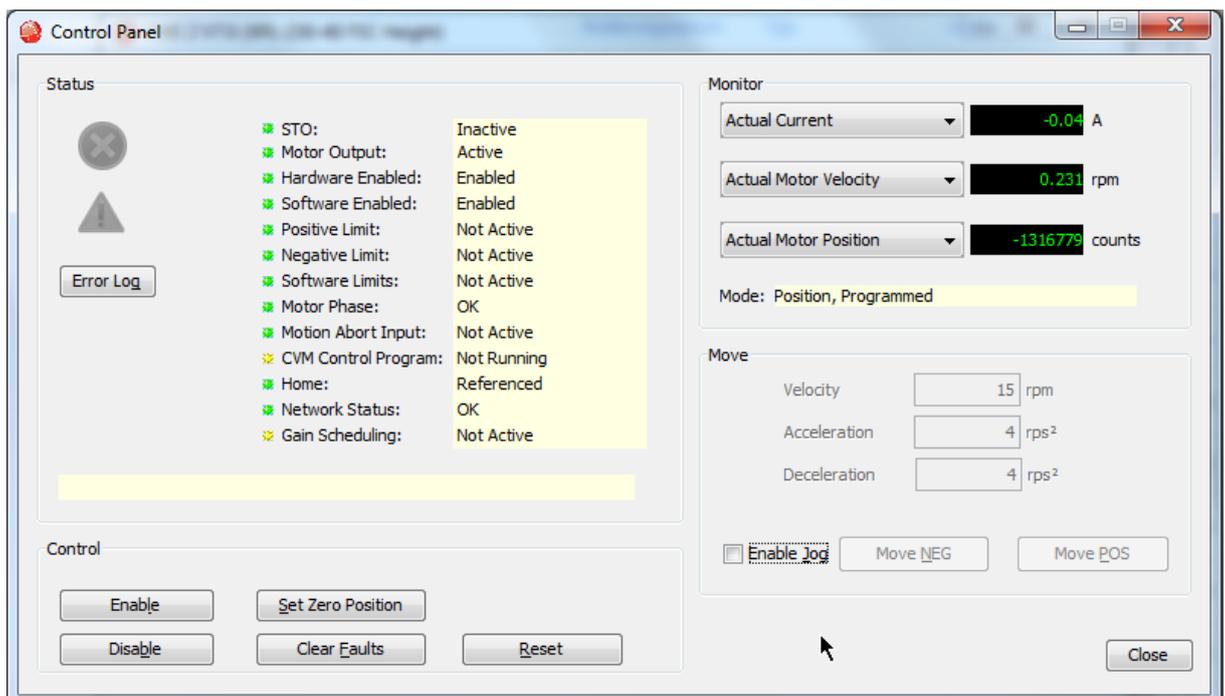
Check if the Actual Position is still "0"

13. Move in Jog Mode negative into the Park position
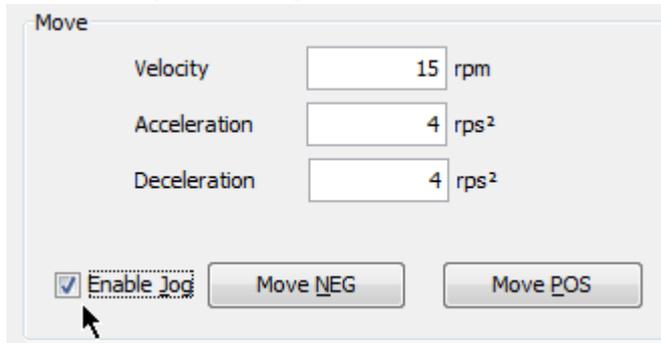
14. Disable Jog Mode
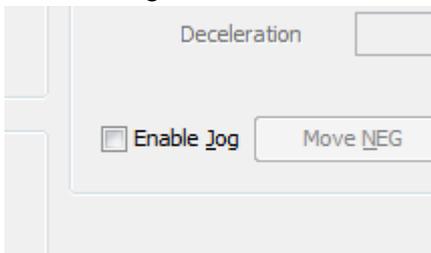
15. Disable Drive
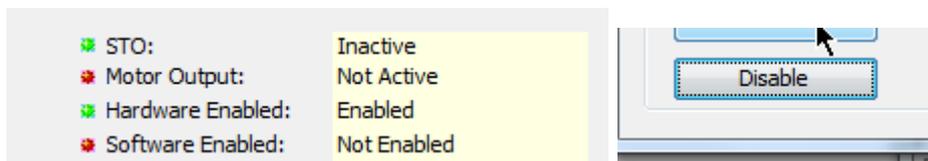
4.4 Drum Homing

Important: Insert centering jig (white ring) into DSF, the Monitoring Segment must be Segment 1!

In order to have the drum home in the right position the DriveGUI Software should be started. Jog (in DriveGUI or Khan SW) with drum in the correct position (Centering Bolt/Finger should fit in the bolt hole). And save the Home position and press the following button (yellow marked).
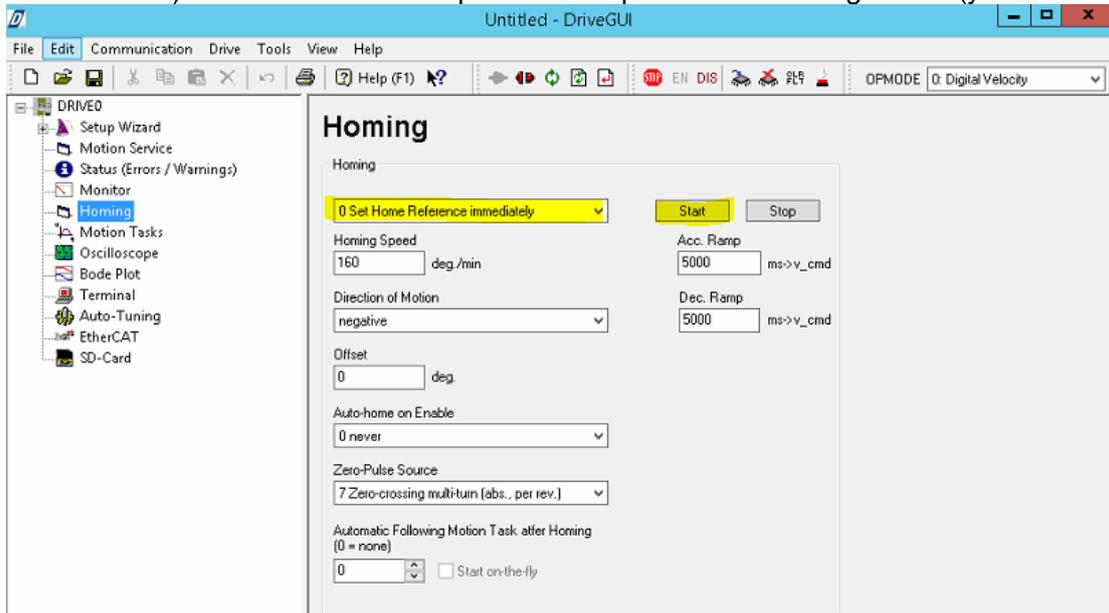
To prevent that the drum rotation will lose its home position after a power off, disable the drive and type the "HSAVE" string in the terminal. Enable the drive again and save it to the Flash Memory.
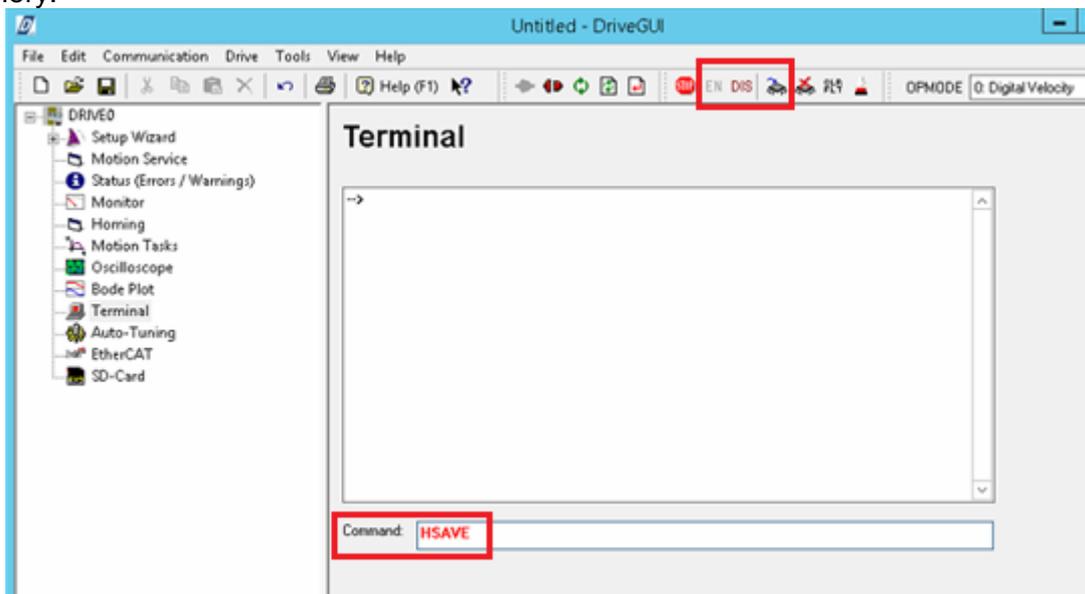
4.5 The DSF Rotation Homing Position

StartUp Xenus Drives	Khan Config	Homing DSF Height	Homing Drum	Homing DSF Rotation

After the homing procedure, the Centering Bolt (Flip Finger) fits into the guiding pin and has the position 0°.
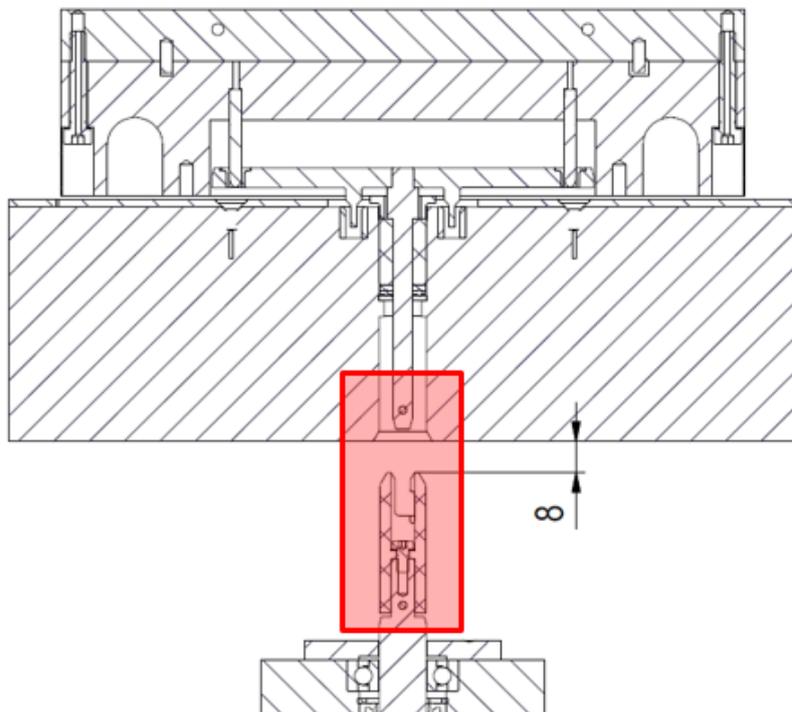
4.5.1 Flip Rotation Homing routine

Do the Homing the same way you did on the Flip Height drive. Important: before homing: set Position Wrap to "0 counts". After homing routine, set the Position Wrap to the old value (196608 counts).

→ Open P-Loop
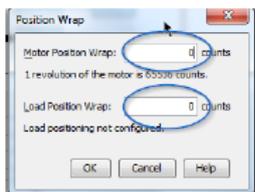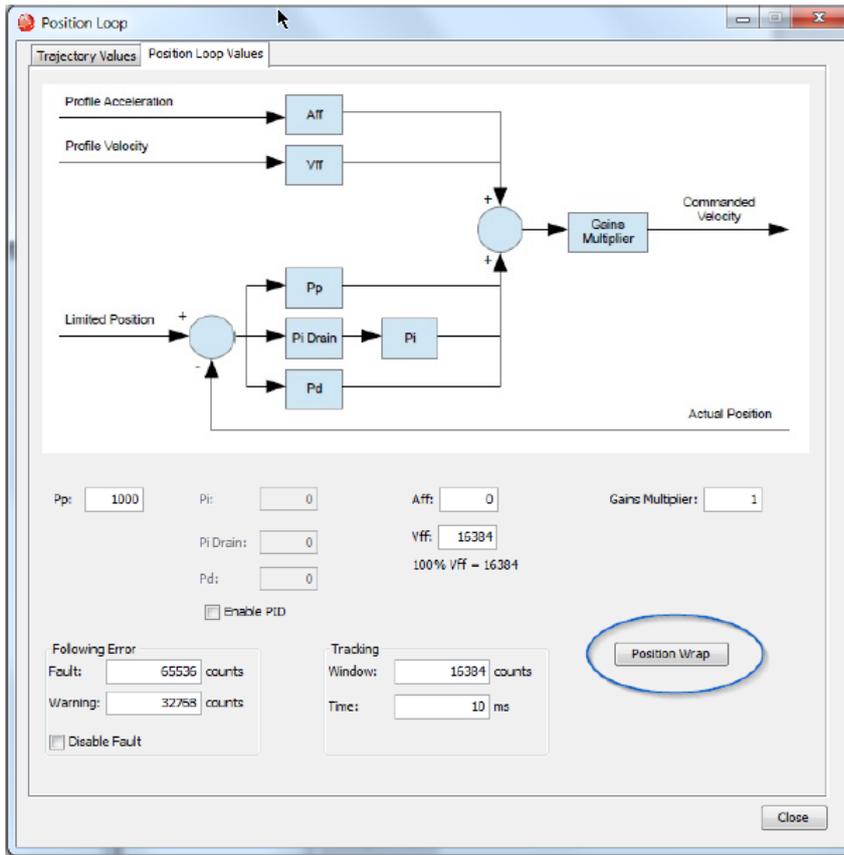
4.6 Flip Supervision

4.6.1 Introduction

There are two different kind of laser sensors mounted at the lower chamber viewport. The tool Supervision is a slit laser and the Segment Supervision is a point laser. If the door is open, lasers must be off
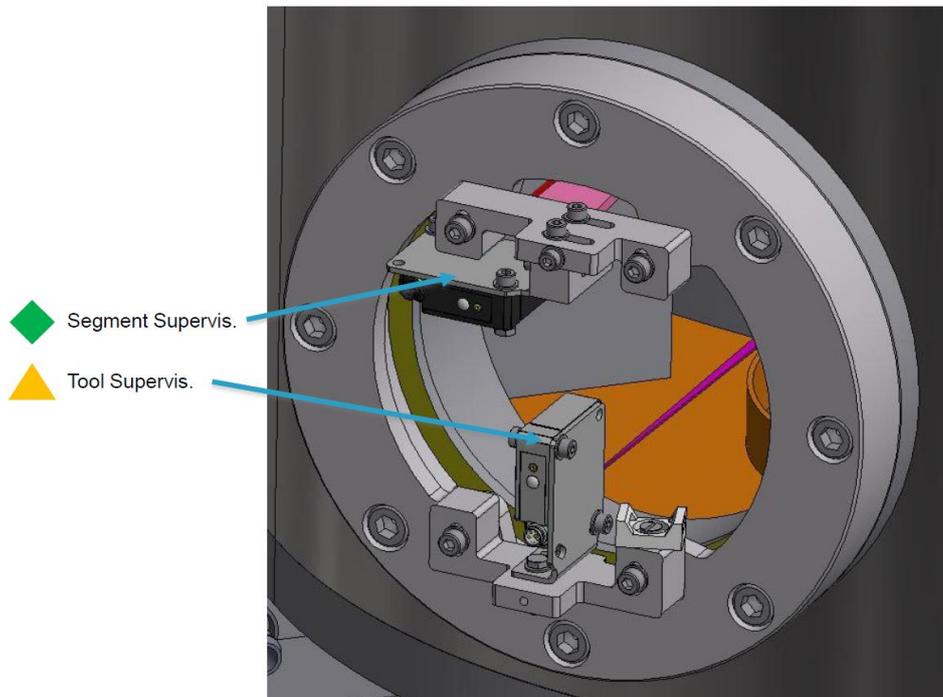
4.6.2 Teaching the lasers

Within 5 minutes after power-up, the button may be used to teach a new range. After finishing a teach procedure, the 5 minutes starts again. After 5 minutes the sensor does not respond to pressing the button. Seven steps to teaching a new measuring range:

1. Press (and hold) the button. The red LED will turn on, if the sensor can be taught.
2. Hold down the button for 5 more sec. The LED will start to blink.
3. Release the button.
4. Place a target at the first new position of the measuring range. This is the position that will later produce 0V.
5. Briefly press the button again. The LED will stop blinking and will stay on for about 3 sec to indicate that the first position has been stored. Then the LED will blink again.
6. Now place the target at the second position (the other end of the new range), which will produce 10V.
7. Briefly press the button again. The LED will stop blinking and will stay on for about 3 sec to indicate that the second position has been stored. The LED will then turn off and blink once more. Now the sensor is ready to measure.

The new, smaller operating range is now set. The red LED now indicates whether an object is within the new range (LED OFF) or not (LED ON). If one of the new border of the range was outside the standard range or the two positions were too close to each other, then the new settings are not valid. The Sensor will respond with an extended blinking at the end of the teach procedure. The previous settings are still valid and the new settings are lost.

Segments

Aim laser point to the lower left corner of the thick part of the Adapter Plate Bottom
(see red arrows in picture below)
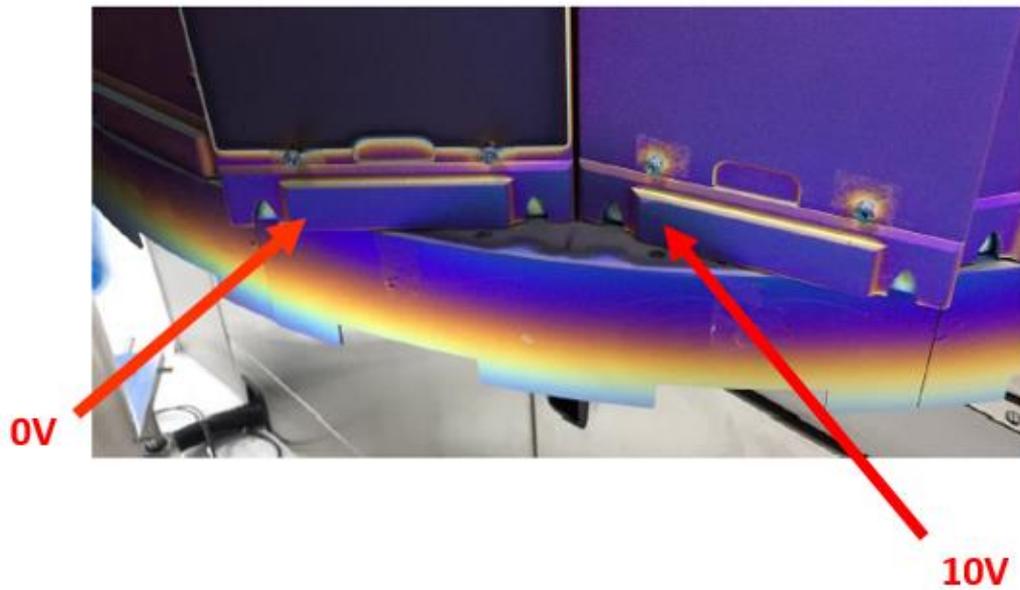
The aligned Segment Position will be around 5V (Khan Analog Input: ~500)

Tool
Aim laser line to the left hook of the Centering Bolt (Flip Finger)
(see red mark in picture below)

So the Tool is fine from 0-5V (Khan Analog Input: 0-500). If the Value is higher than 500, the tool is may be broken.

4.6.3 Khan Configuration

The values must be verified during cycle tests. Insert the same values for front and backside.
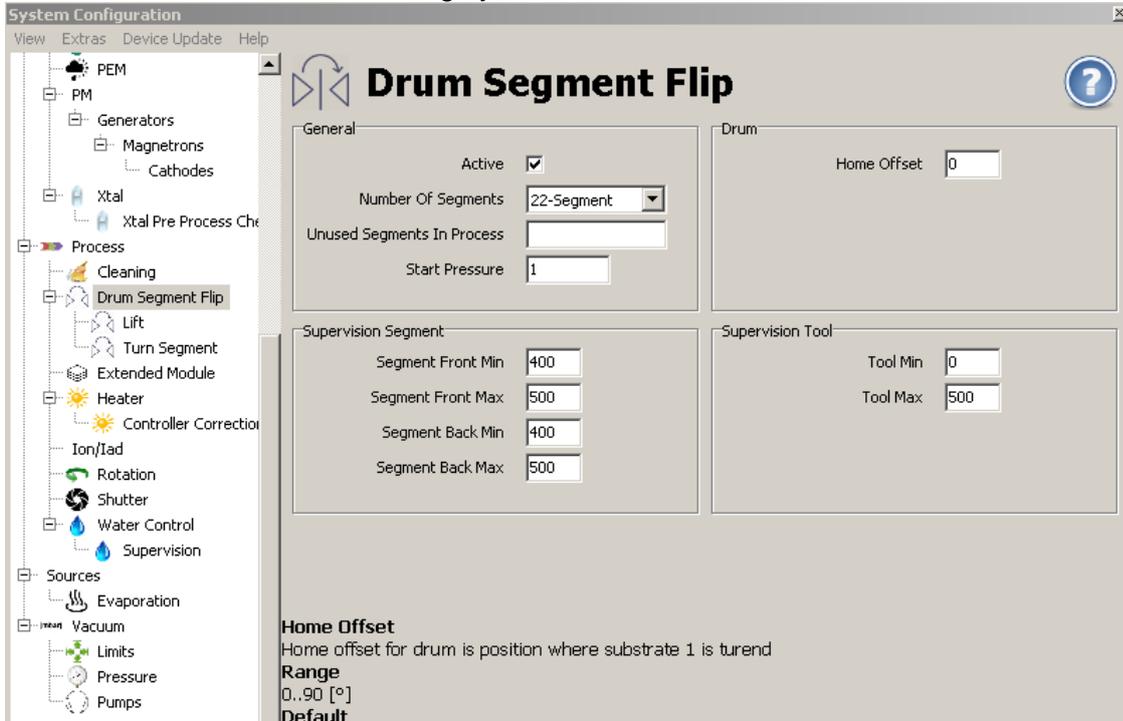
4.6.4 Supervision flip sequence
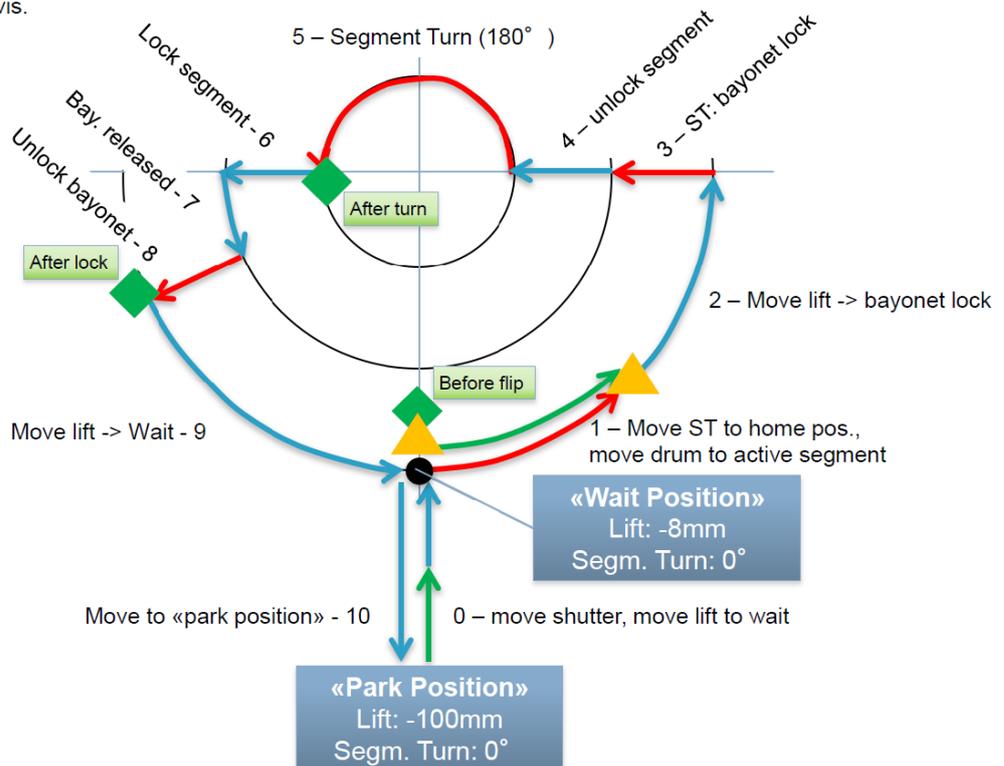
4.6.5 Khan Supervision Chart

Add the Analog Inputs in a Chart for the DSF Supervision.

Example

Check schematics for the right Analog Input on page 370.
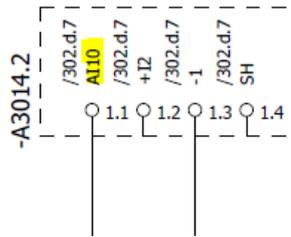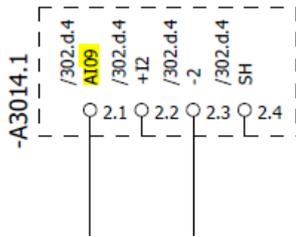
Go to Menu > Display > Chart x and add the Analog Inputs.
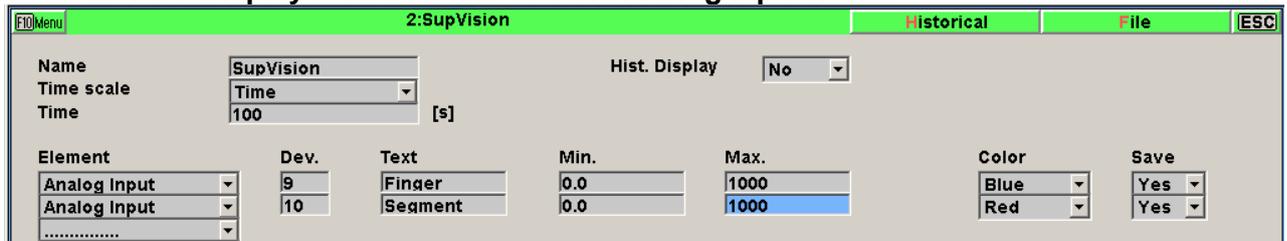
After a Flip cycle the Supervision chart should look like this:
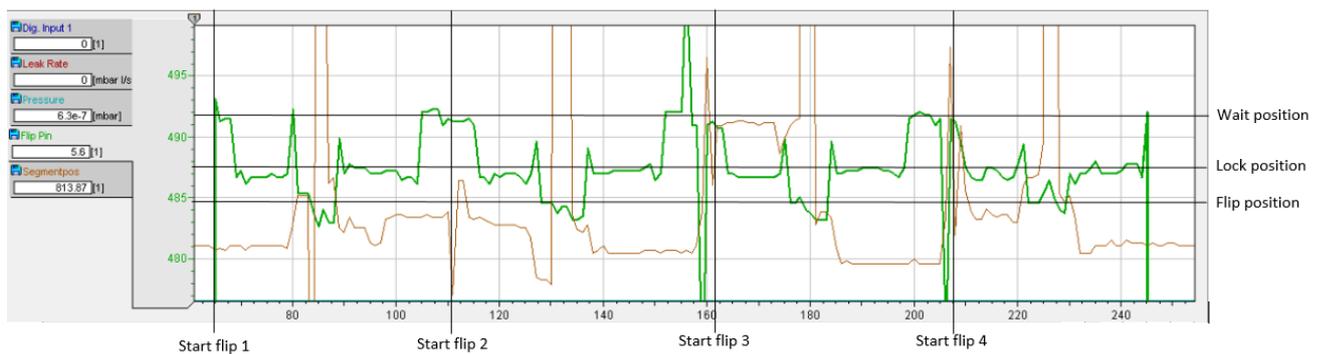
4.6.6 Flip Supervision Maintenance

The laser sensors of the Flip Supervision need to have clear sight into the chamber, onto the drum segments and the Centering Bolt (Flip Finger). A dirty or coated view port may lead to failure of the supervision function and thus to unnecessary errors or worst case to damage.

4.7 Process

In order to activate the Flip mechanism for production the recipe has to be changed. In the Pretreatment module in the submenu "NEXT" the tick for flipping needs to be activated. If the process starts it will automatically flip all segments before the coating happens. To start a double sided coating an additional program "PMT" has to be used. It can be opened in the Element→DSF screen. An important detail for processing is the fact that the backside will be coated first.
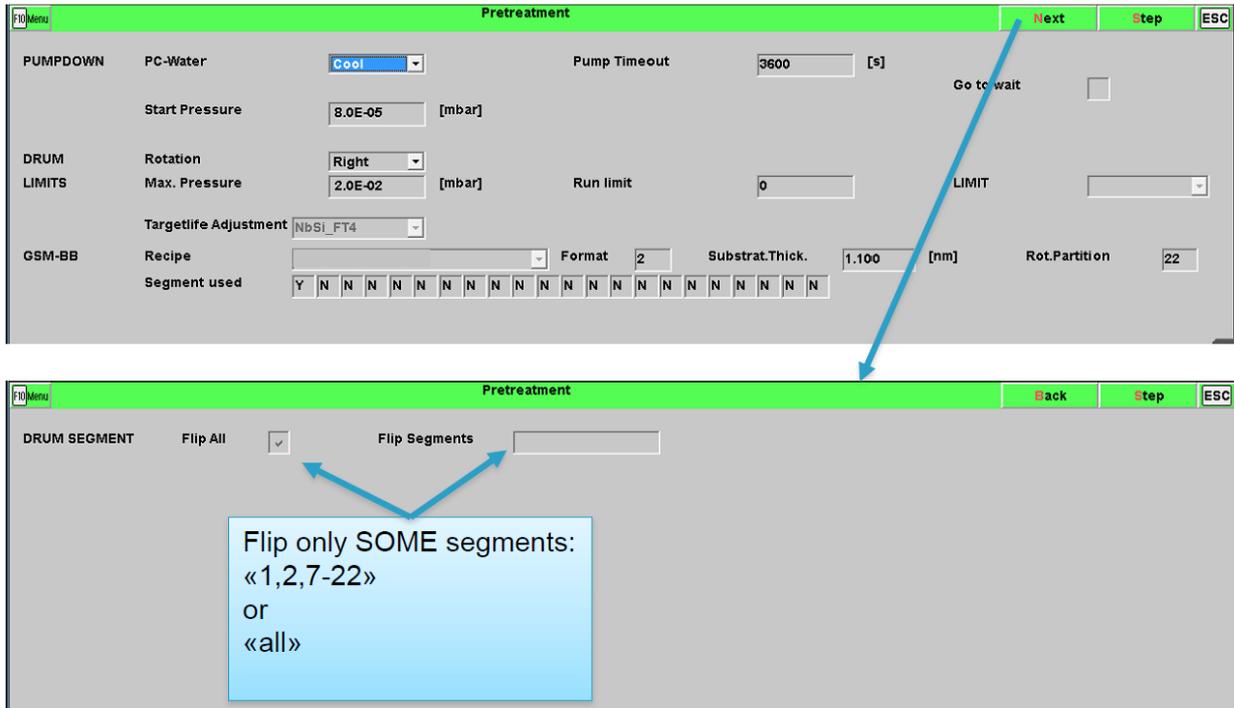
4.7.1 PMT

Open Process Management Tool from KHAN server desktop (Icon), via «Alt-Tab», or via KHAN -> Element -> DSF -> PMT Button

1 – Establish Connection (if not connected)
2 – Process window
3 – Update Recipe List
4 – Chose two recipes
5 – check that sequence (A- / B-side) is correct
6 – Add Meta-data (Operator / Batch ID / comments
     -> recommended to indicate Segment front / back side)
7 – Start «Two sided process»
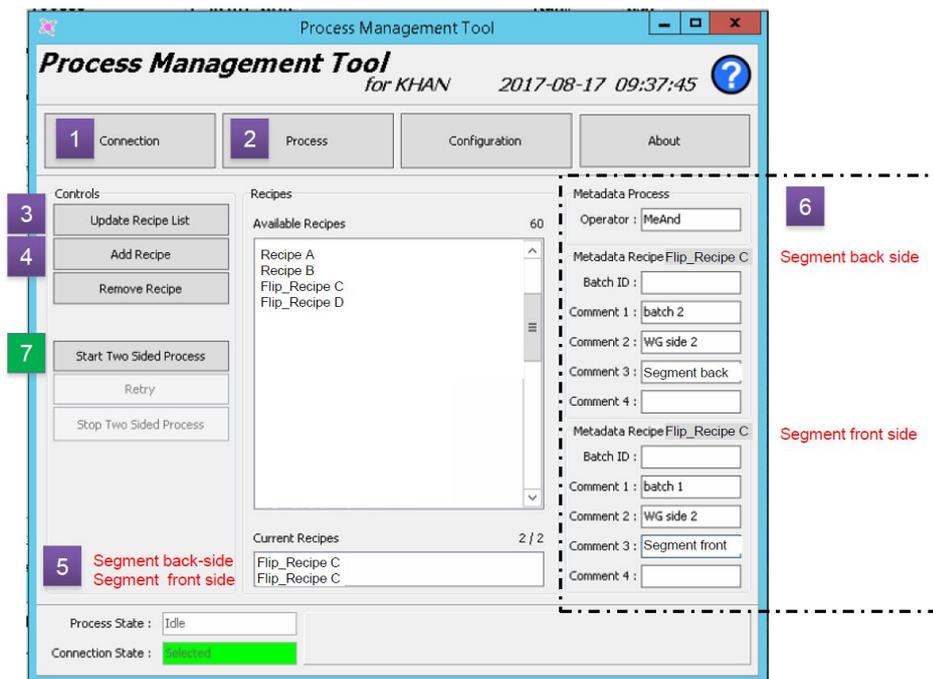
4.8 Run preparation

To ensure that the system is ready to run the flipping some steps are needed to check.
Before running a two sided process, make sure the segments can rotate.

With a feeler gauge, check the minimum gaps.

1 – 2mm

0 – 0.5mm

0.5 – 1mm

0.5 – 1mm
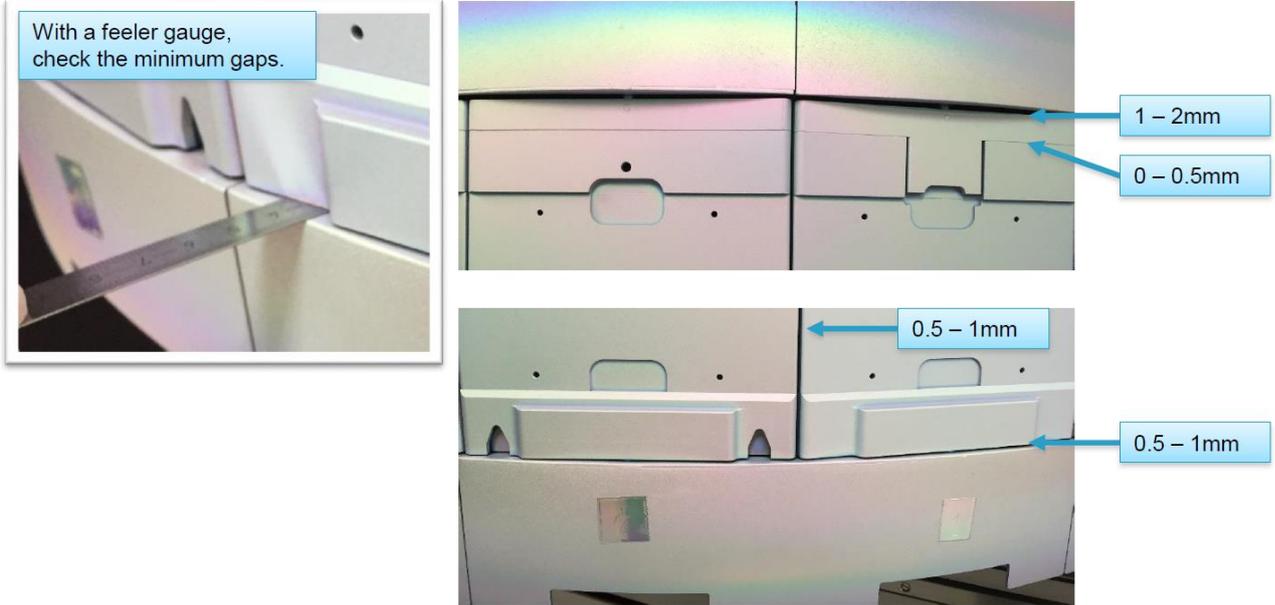
Before running any process, make sure there is enough space for the shutter.

Shutter

Segments

> 5mm at top of drum

> 5mm between pins / shutter on BOTH sides of segments

> 5mm at bottom of drum
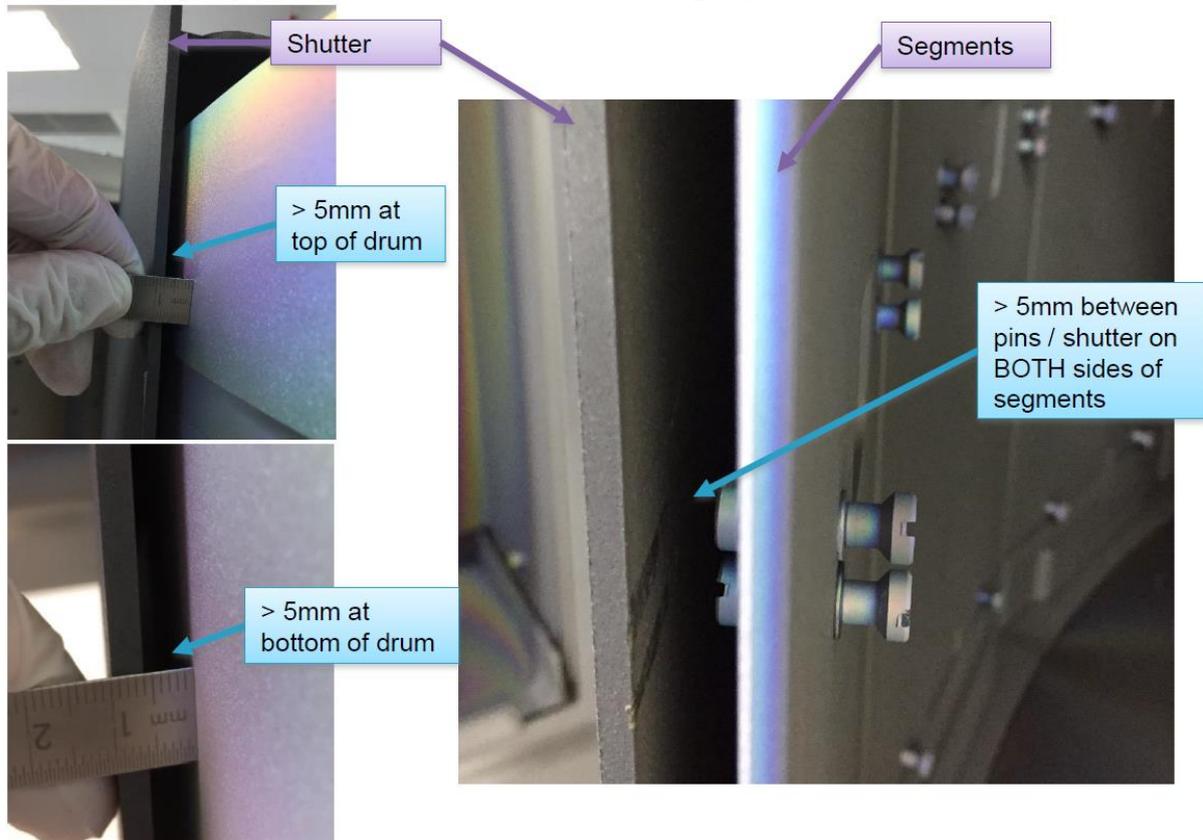
With the Segment Turning Tool, check that the segments can turn without any collisions.

Gap points to drum center	Put tool into hole, lift up locking bolt	Turn segment to «right»	Stop segment and pull down to lock segment	«Wiggle test» to make sure, segment is locked

5 Troubleshooting

5.1 The "Circle of Flip"

The «Circle of Flip» starts at «Park Position». When a complete drum gets flipped, the system first goes to «Wait Position» and then runs through the cycle (steps 1 – 9) for each segment. After the last segment, the system will go back to «Park position».

The three shells of the "Circle of Flip" show, what operations are safe or critical to do:
- Vent and open chamber → ONLY in «park position»
- On outer shell (Step 0 – 2; 9-10): Safe to move lift DOWN (negative direction)
- On middle shell (Step 3-4; 6-8): DANGER ZONE! Only limited lift / segment turn movement allowed
- On inner shell (Step 5): Safe to rotate segment

For actual settings, see «system configuration»

→ Process → Drum Seg.F.
- Lift
- Turn Segment

«Park Position»
Lift: -100mm
Segm. Turn: 0°

Step	Lift	Segment Turn
0	Fast «Wait» (-8 mm)	(0°)
1		Absolute «home» (0°)
2	Slow «Bay. Lock» (+16mm)	(0°)
3	(+16mm)	Absolute «Bayonet lock» (about 60°)
4	Slow «Seg. Unlocked» (+28mm)	(about 60°)
5	(+28mm)	Absolute «Turn + Bayonet lock» (about 240°)
6	Slow «Seg. Locked» (+14mm)	(about 240°)
7	Slow «Bay. Released» (+15mm)	(about 240°)
8	(+15mm)	Absolute «Turn» (180°)
9	Slow «Wait» (-8 mm)	(180°)
10	Fast «Park» (-100mm)	Absolute «home» (0°)

5.2 Failure Recovery

5.2.1 General fail

1. Find current status in "The Circle of Flip" → Visual check in chamber / DSF element values

2. Finish "the Circle of Flip" for active segment

3. Go to "Park Position"

4. Hit "Retry" → Khan will automatically retry the pretreatment step and continue with NEXT segment

5.2.2 "Tool Supervision" fail

1. Visually check if tool is still ok (both hooks are there)

2. If yes: "DSF Element → Continue"

   If no: move DSF to "Park position", vent chamber, check all segments, replace Centering Bolt (Flip Finger), pump and "retry" → KHAN will automatically resume flipping NEXT segment

5.2.3 Recovery – Example
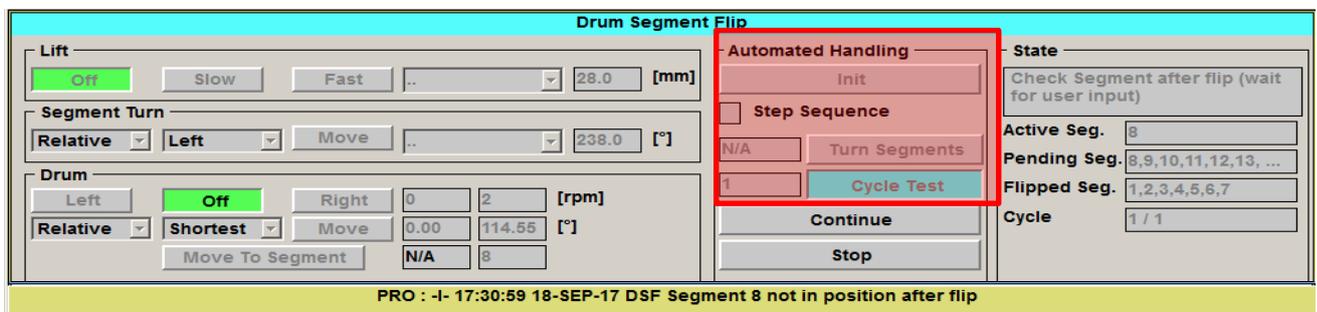
Example: Alarm «DSF Segment 8 not in position after flip»

1. Find current status in «Circle of Flip»
    → Visual check in chamber / DSF element values: 28mm / 240°=> after

2. If segment position is ok, then hit «Continue»
    If segment position is not ok, then hit «Stop»,
    Finish «Circle of Flip» for active segment □ Active segment = 8

3. Go to «Park Position»

4. Hit «RETRY»
    → KHAN will automatically retry the pre-treatment step and continue with NEXT segment,
    i.e. segment 9

5.3 Test Functions
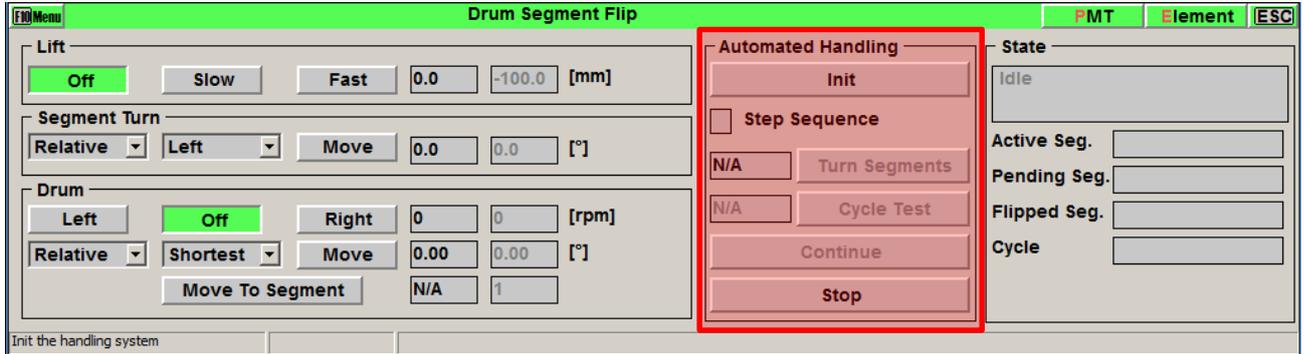
Further functions:
Init: Initiate drives (no movement involved) → idle state

Step sequence (Check box): The next sequence will wait after every step and wait for confirmation «Continue» (debug mode)

Turn Segments: Automatically flip defined segments («1,2 or 7-22»)

Cycle Test: Run defined number of complete drum flips

Move to Segment: Rotate drum («right move») to position the selected segment ready for flipping

5.4 Xenus Drive Current logging

5.4.1 Configuration

The data are recorded via trace logging. For recording, no special tools are necessary than the usual one installed with the Khan setup.

5.4.2 Khan

In Khan, label handling must be activated during data logging.
F10 → Configuration →Software Configuration → Logging

Screenshot Datenlogging-Konfiguration

5.4.3 Data Analysis (LogGatherer)

The data is stored in the folder C: \ Trace \ Data. Either they can be copied manually from the system or with the LogGatherer tool. Important when using the LogGatherer is that the data logs are selected (see screenshot).
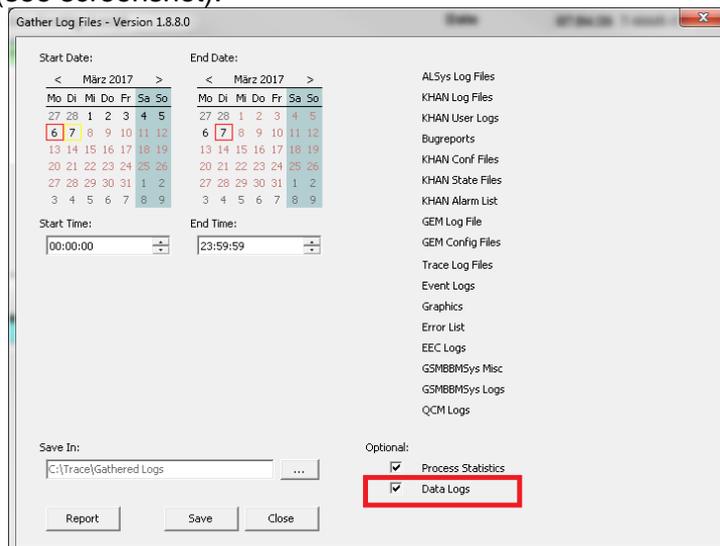
The data is stored in a file with the extension .dat. The file size is limited, there may be several files per day. The file stores the values for each variable name. Now the .dat format is useless for analyzing and evaluating, so this format can be converted to .csv.

5.4.4 Convert to a .csv file

Using the Trace Analyzer tool, a .dat file can be converted to a .csv file. This means that all Excel tools are available for analysis and evaluation.
In order for the conversion to be made, the Trace Analyzer tool must be installed. This can be done from the Trace Analyzer using the menu item "Convert dat File To csv".

The operation of the conversion tool is self-explanatory.

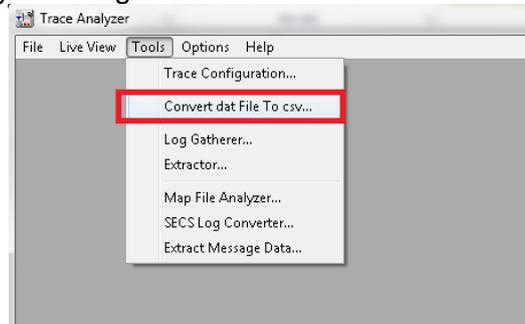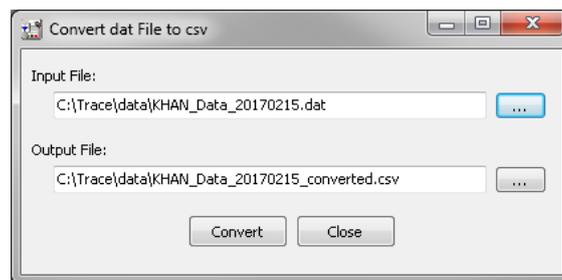In the converted .csv file there is one column for each variable, with the time stamp on the left and the value on the right.
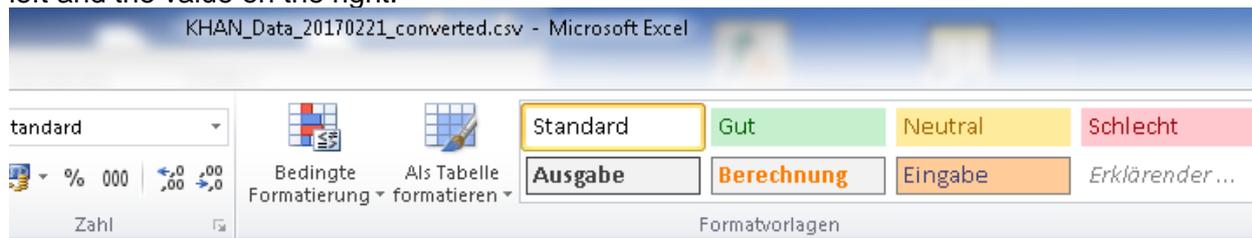
I	J	K	L	M	N	O
	DsfLiftCtrl #1 Current	[A]		DsfSegmentTurn #2 Current	[A]	
	16:25:00.667	0.03		16:25:11.016	0.33	
	16:25:00.698	0.14		16:25:11.062	0.19	
	16:25:00.735	0.15		16:25:11.137	0.37	
	16:25:00.777	0.1		16:25:11.182	-0.17	
	16:25:00.817	0.07		16:25:11.230	-0.04	
	16:25:00.850	0.12		16:25:11.265	0.34	
	16:25:00.904	0.08		16:25:11.324	0.32	
	16:25:00.938	0.11		16:25:11.379	-0.04	
	16:25:00.969	0.11		16:25:11.424	0.04	
	16:25:01.014	0.1		16:25:11.481	0.27	
	16:25:01.045	0.09		16:25:11.527	0.39	

5.5 Error List

DSF Alarms			
DSF	1	Controller Lift	The lift controller has an error during positioning. See its error message for more details.
DSF	1	Controller Segment Turn	The segment turn controller has an error during positioning. See its error message for more details.
DSF	1	Controller Drum	The drum controller has an error during positioning. See its error message for more details.
DSF	1	Position Timeout	The general position timeout. If a controller (lift, turn segment, drum) does not reach its defined nominal position within a predefined time this error occurs. There must be something wrong either with the controller or with the mechanical parts.
DSF	1	Chamber not closed	Chamber is not closed when a DSF sequence starts.
DSF	1	Invalid Lift Position	During the flip sequence the position check of the lift failed. Check its mechanical position.
DSF	1	Invalid Shutter Position	During the flip sequence the position check of the shutter failed. Check its mechanical position.
DSF	1	Invalid Segment Turn Position	During the flip sequence the position check of the turn segment failed. Check its mechanical position.
DSF	1	Invalid Drum Position	During the flip sequence the position check of the drum failed. Check its mechanical position.
DSF	1	Pressure too high	There is a minimum pressure configured before the flip sequence can start. This minimum pressure is not reached within the predefined timeout. Check the chamber for leaks.
DSF	1	Tool not in position	The tool check failed. The read value from the supervision sensor is out of the configured window. Check the tool and may continue the flip sequence with the button Continue.
DSF	1	Segment not in position before flip	The segment supervision check failed. The read value from the supervision sensor is out of the configured window. Check the segment for mechanical failure.
DSF	1	Segment not in position after flip	The segment supervision check failed. The read value from the supervision sensor is out of the configured window. Check the segment for mechanical failure.
DSF	1	No used segment available	The choosen segments for flip are all configured as unused segments. Check configuration and the choosen segments.