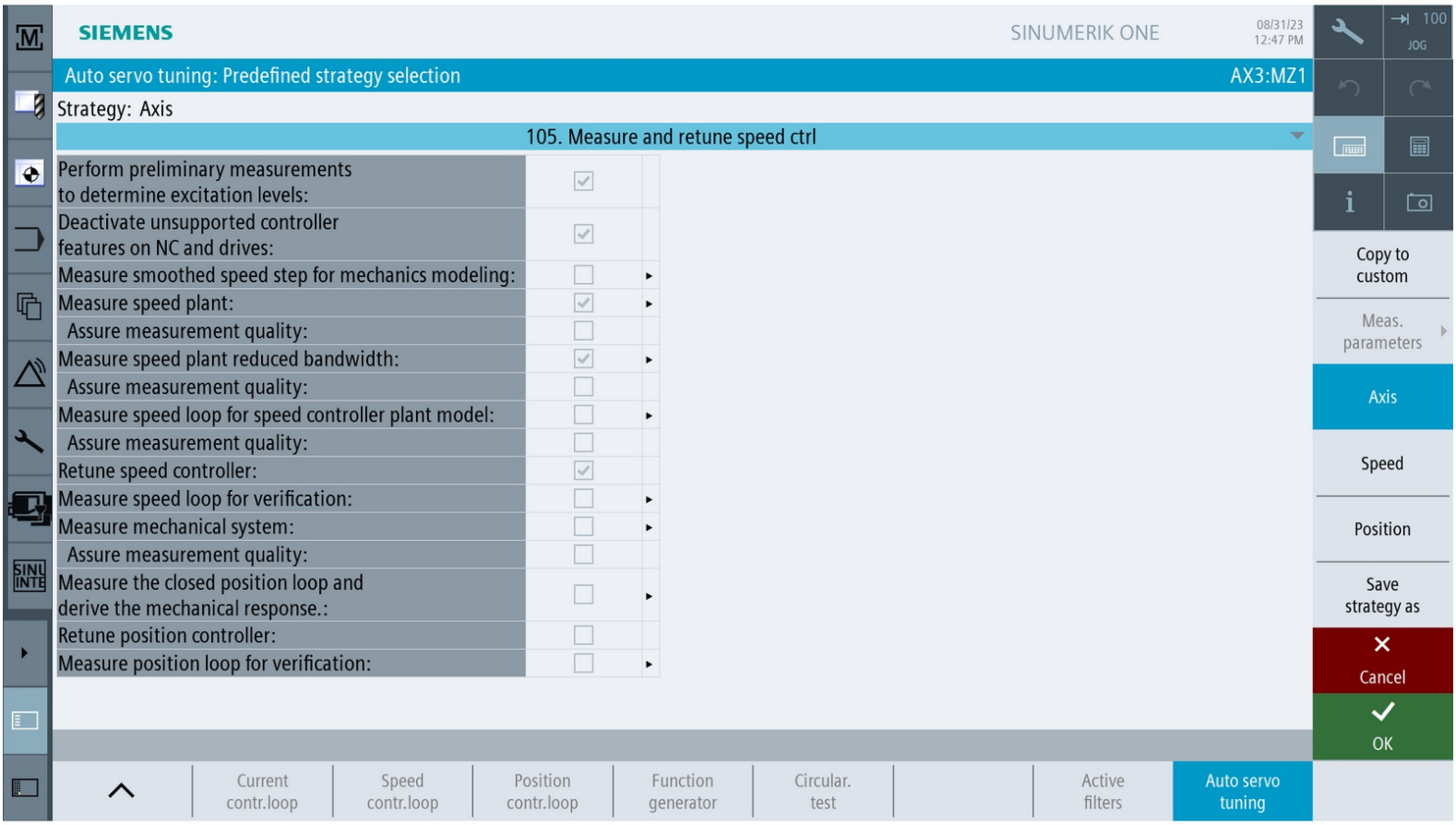
VMCsi & TCsi - Axis Tuning Using Auto Servo Tuning (AST)

Autotune

Written By: Dylan Parr

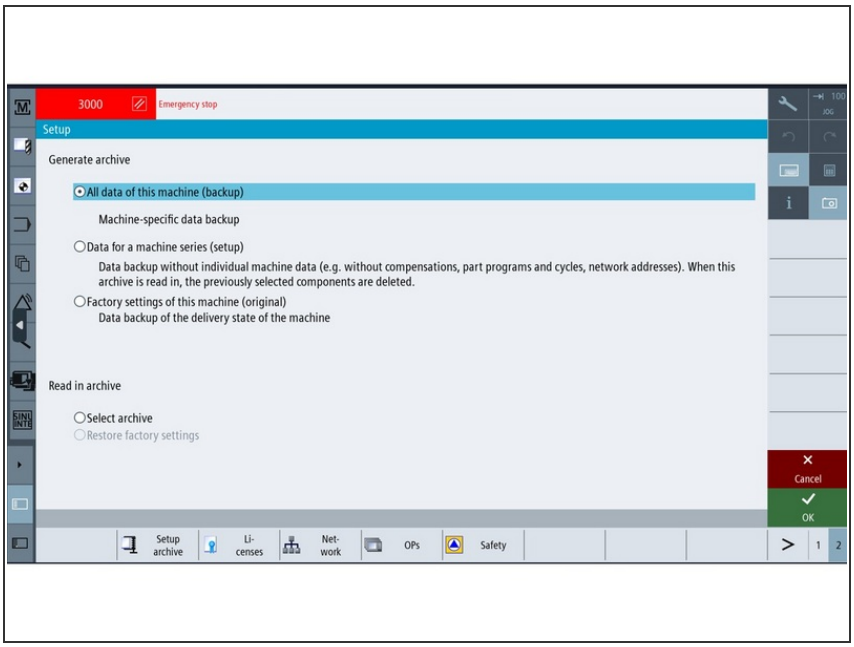


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INTRODUCTION

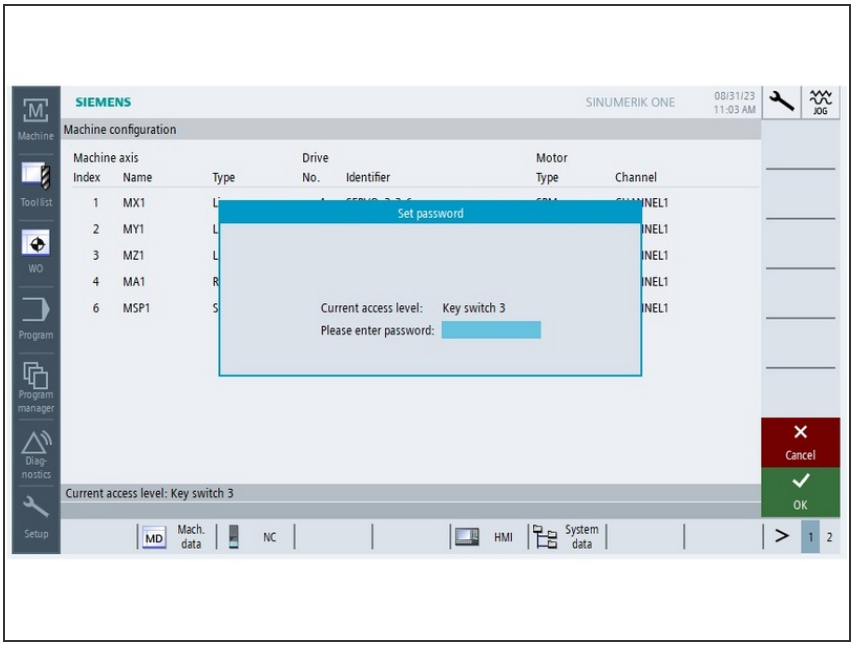
This guide provides a complete procedure for Axis Tuning using Auto Servo Tuning (AST) for VMCsi and TCsi machines to eliminate motor humming noise and reduce resonance.

Step 1 — Make Starting Archive



- Archive the current system before making any changes.
  - Archive Current System

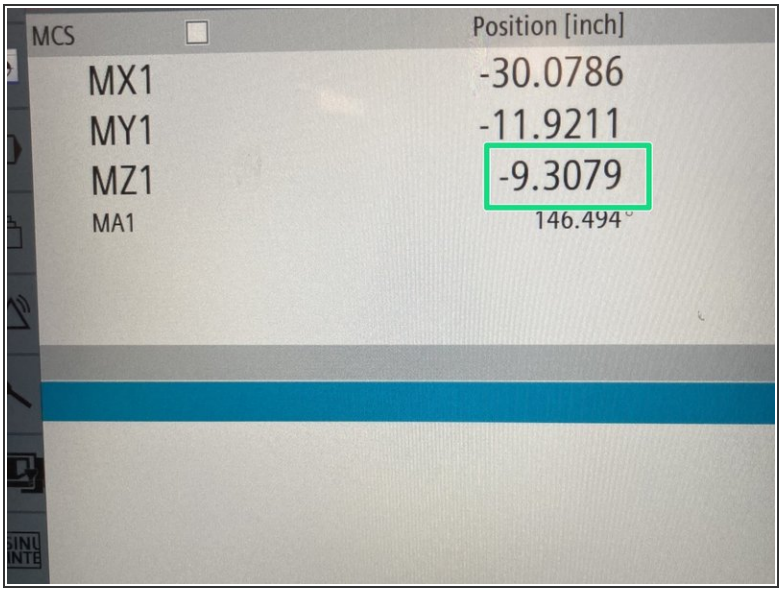
Step 2 — E-Stop and Manufacturer Access



- Set Manufacture Password.
  - ⓘ TRAKmt2021

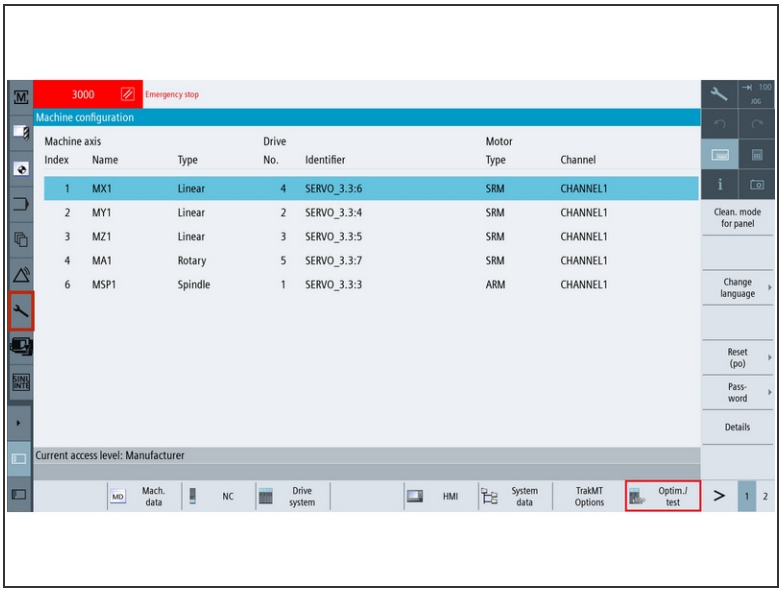
Step 3 — Safe Axis Position for Linear Axis

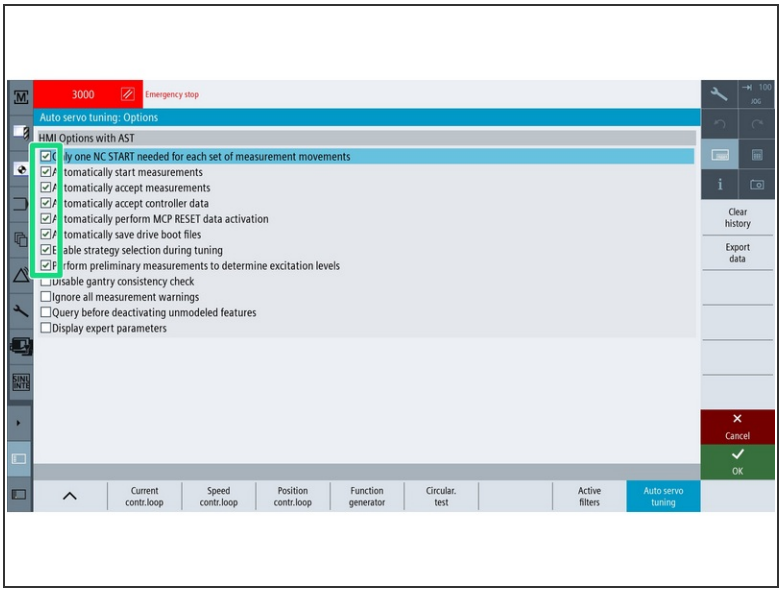




- Release **[E-Stop]** to enable drives.
- Jog all the axis to a safe tuning position. The center of travel is ideal.

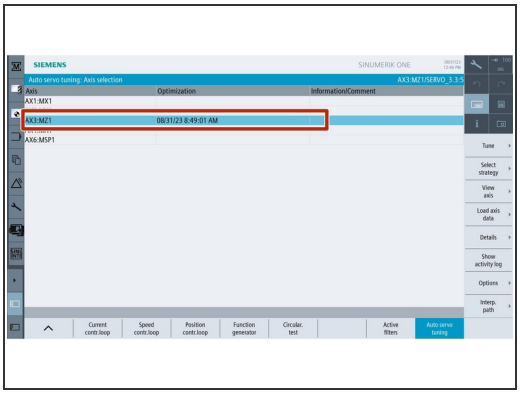
Step 4 — Accessing the AST Tool

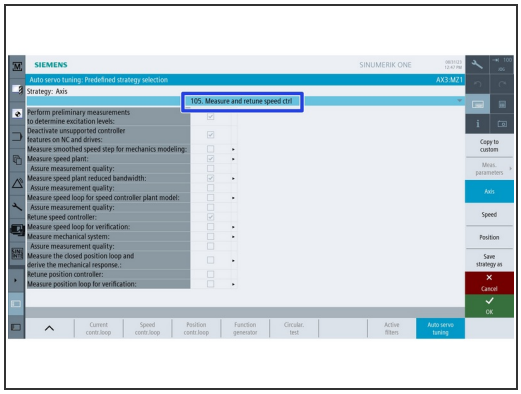


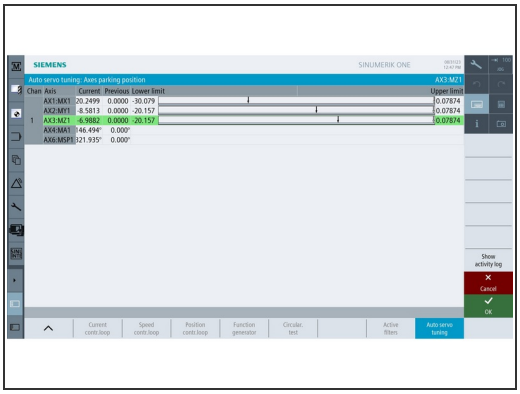


- Navigate to **[Setup]** → **[Optim/test]**.
- To clear the previous tuning history, select **[Options]** → **[Clear History]** → **[Yes]**.
- Set the **"HMI Options with AST"** as follows: check the first 8 boxes.
- Press **[OK]** → **[OK]** to confirm.

Step 5 — Initiate Tuning for X, Y, and Z

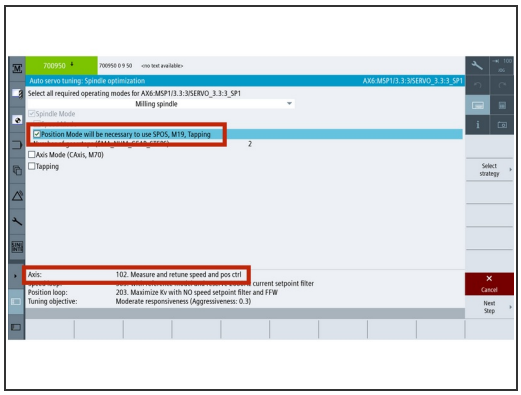


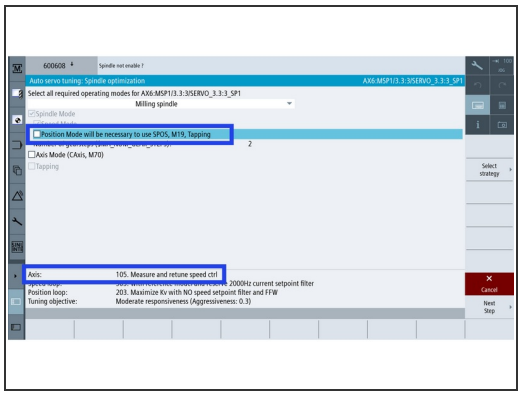




- Select desired axis, then **[Tune]**.
- From the menu, select "Strategy 105. Measure and Retune Speed ctrl," then press **[OK]**.
- The position of the axes relative to the active soft limits is displayed. Ensure everything is positioned in a safe location, as the Z axis will move up to 6" in both positive and negative directions during testing.
- Once the safe position is set, select **[OK]**.
- Proceed to **Step 10**.

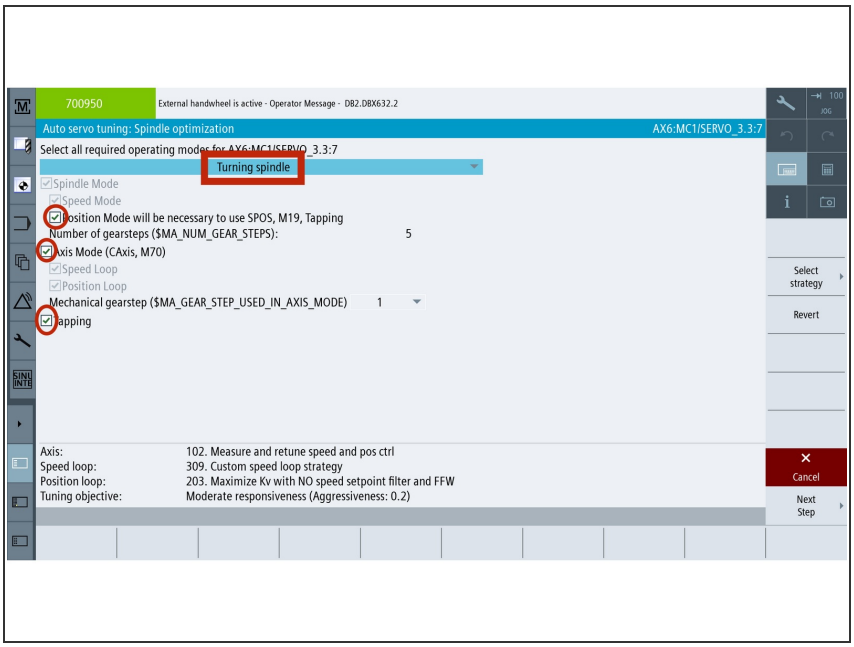
Step 6 — Spindle Specfic Tuning



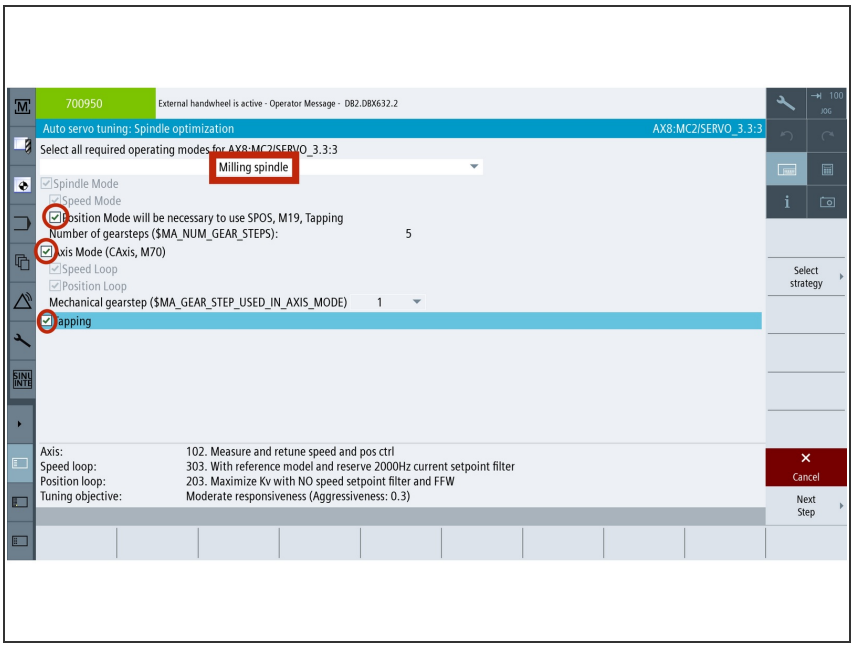
- Select **AX6:MSP1** from the axis selections on the left.
- Select **[Tune Spindle]**. From the drop down menu Select **[Milling Spindle]**
- If this is the first time running Auto Tune on the spindle:
  - Check the first available checkbox: "**Position Mode will be necessary to use SPOs, M19, and Tapping.**" At the bottom of the page the Axis should read **102. Measure and retune speed and pos ctrl.**
- If this is not the first time:
  - Deselect the checkbox mentioned above. At the bottom of the screen the Axis should read **105. Measure and retune speed ctrl**
- Press **[Next Step]** → **[Tune]** → **[OK]**
- Proceed to **Step 10**.

Step 7 — (LTY) MC1 Specific Tuning



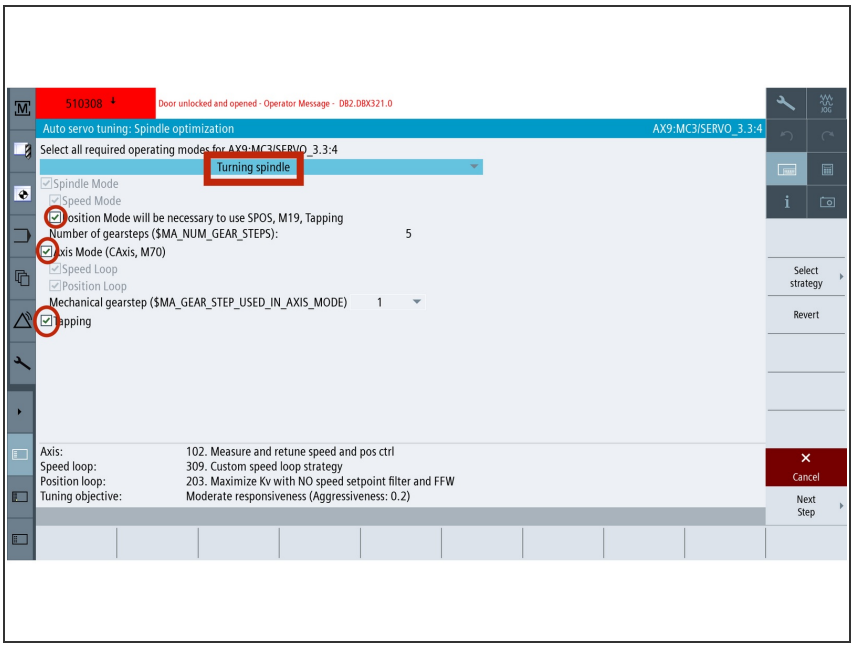
- Select **AX6:MC1** from the axis selections on the left.
- Select **[Tune Spindle]**. From the drop down menu Select **[Turning Spindle]**
- Verify these are checked: **(1)** Position Mode will be necessary to use SPOs, M19, and Tapping. **(2)** Axis Mode (CAxis, M70). **(3)** Tapping
- Press **[Next Step]** → **[Tune]** → **[Speed]**
  - Set 'Min integral time Tn: = **0.02**s
- Press **[OK]** to open the Auto Servo Tuning: Axis Parking Position screen, then press **[OK]** again to start Auto Tuning.
- Proceed to **Step 10**.

Step 8 — (LTY) MC2 Specific Tuning



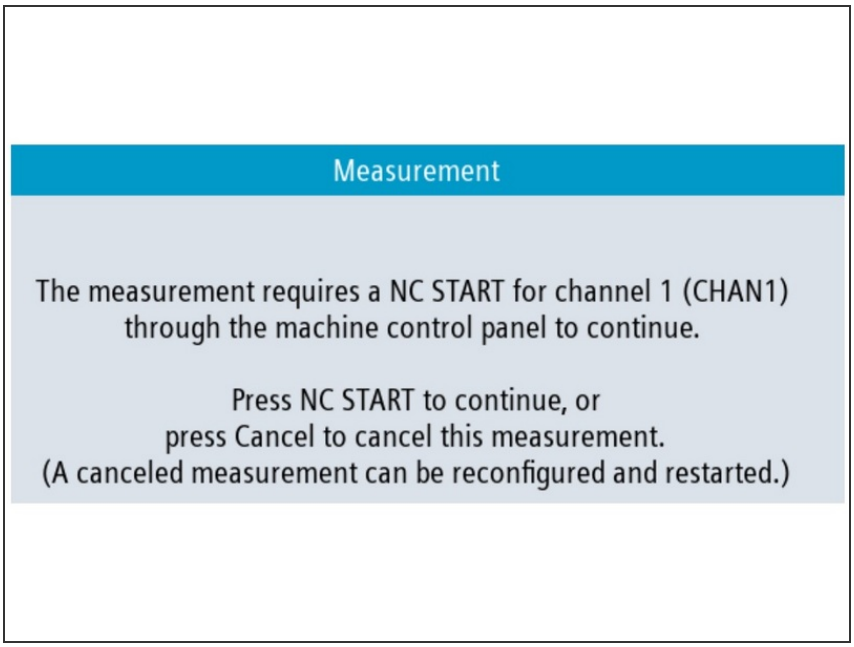
- Select **AX8:MC2** from the axis selections on the left.
- Select **[Tune Spindle]**. From the drop down menu Select **[Milling Spindle]**
- Verify these are checked: **(1)** Position Mode will be necessary to use SPOs, M19, and Tapping. **(2)** Axis Mode (CAxis, M70). **(3)** Tapping
- Press **[Next Step]** → **[Tune]** → **[Speed]**
  - Set 'Min integral time Tn: = **0.02**s
- Press **[OK]** to open the Auto Servo Tuning: Axis Parking Position screen, then press **[OK]** again to start Auto Tuning.
- Proceed to **Step 10**.

Step 9 — (LTY-S) MC3 Specific Tuning



- Select **AX9:MC3** from the axis selections on the left.
- Select **[Tune Spindle]**. From the drop down menu Select **[Milling Spindle]**
- Verify these are checked: **(1)** Position Mode will be necessary to use SPOs, M19, and Tapping. **(2)** Axis Mode (CAxis, M70). **(3)** Tapping
- Press **[Next Step]** → **[Tune]** → **[Speed]**
  - Set 'Min integral time Tn: = **0.02**s
- Press **[OK]** to open the Auto Servo Tuning: Axis Parking Position screen, then press **[OK]** again to start Auto Tuning.
- Proceed to **Step 10**.

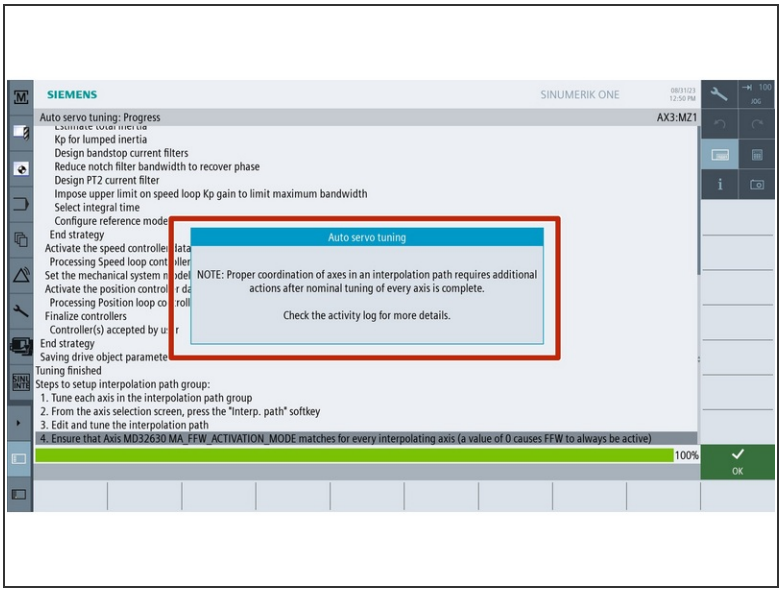
Step 10 — Tuning



- The following Message will appear. Press **[Cycle Start]**
  - ⓘ Note: When **[Cycle start]** is actuated, the measurement process begins. The motor moves at a slow constant feedrate and the frequency response is measured. The measurement process can be stopped via the **[Reset]** key on the MCP or the **[E-Stop]**.
- There are 4 total automated tuning cycles. Each tuning cycle will require hitting a **[Cycle Start]** to initiate.
  - Prelim Speed ctrl. mech. plant. high freq.
  - Speed ctrl. mech. plant high freq.
  - Prelim Speed ctrl. mech. plant low freq.
  - Speed ctrl. mech plant. low freq.
- ⓘ Each tuning cycle will run for approximately 30 seconds, testing travel with different resonant frequencies.

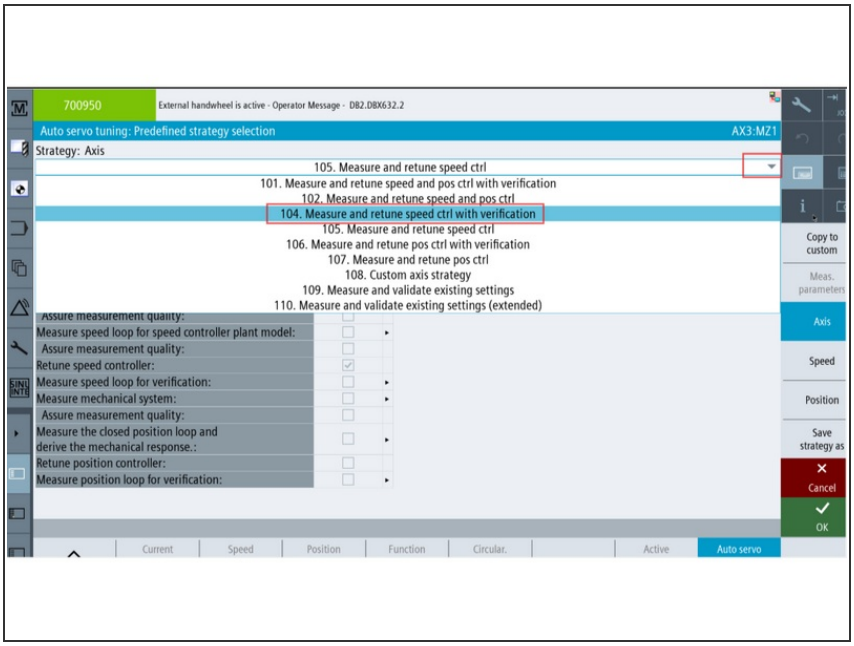
Step 11 — Tuning Completion





- After the 4 steps are completed, the controller review screen appears.
  - **[Accept]** to complete the re-tune process.
- The following message appears which can be ignored because no changes are made to the position controller.
  - Click **[OK]→[OK]** to continue
- Re-Tune process is complete. Test axis movement to confirm the problem is resolved.

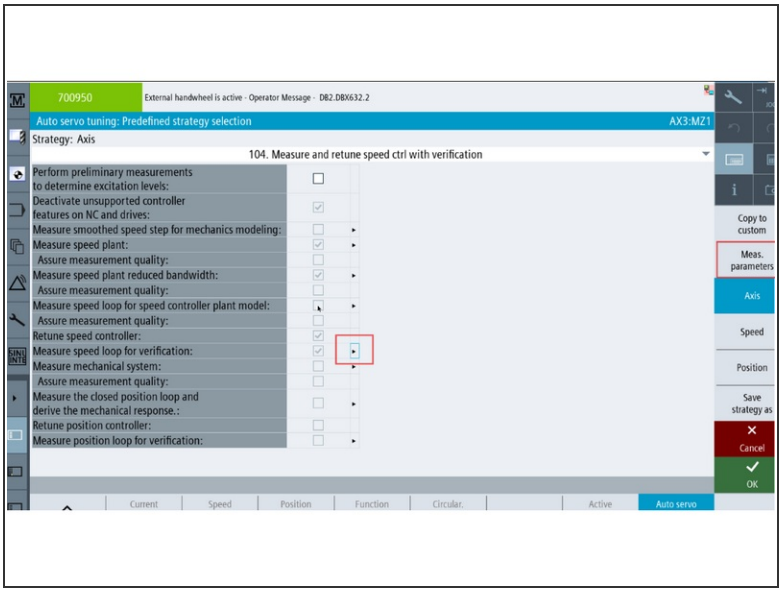
Step 12 — Strategy 104 Retune (VMC12/VMC14 Z Humming Fallback)

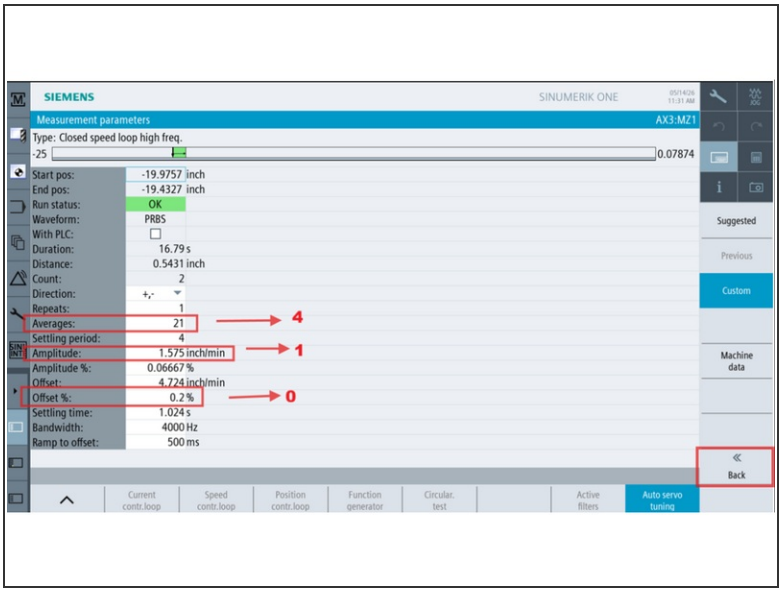


ⓘ **Step 12 thru Step 16** applies only to VMC12/VMC14 Z axis tuning if humming sound persists after AST Strategy 105.

- Return to the AST axis selection screen, select the Z axis (AX3:MZ1), then press **[Tune]** to reach the strategy selection screen.
- From the drop-down menu, select "**104. Measure and retune speed ctrl with verification**".
- Press **[OK]**.

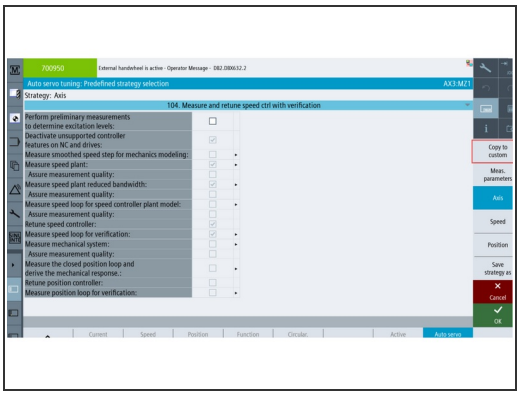
Step 13 — Set Custom Measurement Parameters

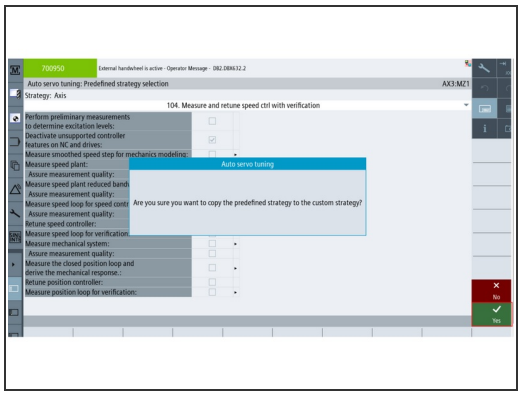


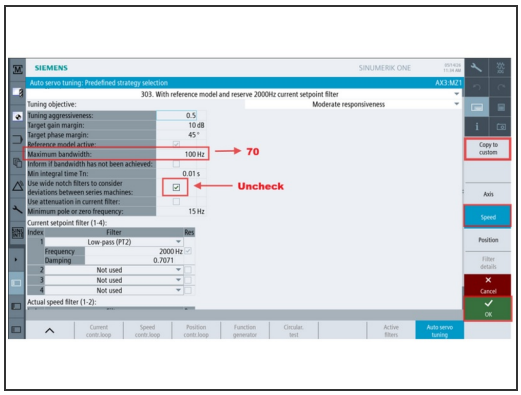


- On the strategy screen, click the **[>]** arrow next to "**Measure speed loop for verification**".
- Press **[Meas. Parameters]**.
- Change the following values:
  - Averages = 4
  - Amplitude = 1
  - Offset % = 0
- Press **[Back]**.

Step 14 — Copy to Custom Strategy and Configure Speed

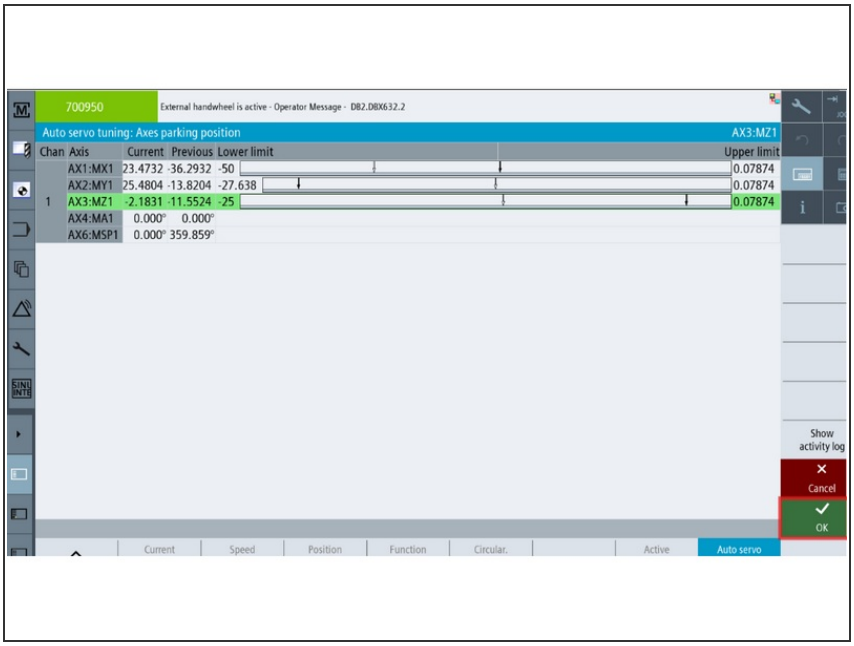






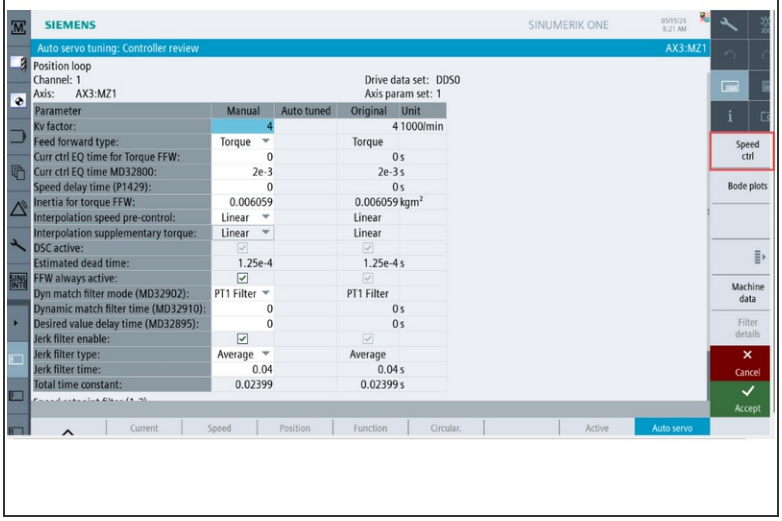
- Press **[Copy to custom]**, then press **[Yes]** to confirm copying the predefined strategy to the custom strategy.
- Press **[Speed]**.
- On the Speed screen, press **[Copy to custom]**.
- Set Maximum bandwidth = **70 Hz**.
  - ⓘ Note: If humming persists after the re-tune, drop the bandwidth in 10 Hz steps (60, 50, then 40 Hz), re-tuning at each step until the humming stops.
- Uncheck "**Use wide notch filters to consider deviations between series machines**."
- Press **[OK]**.

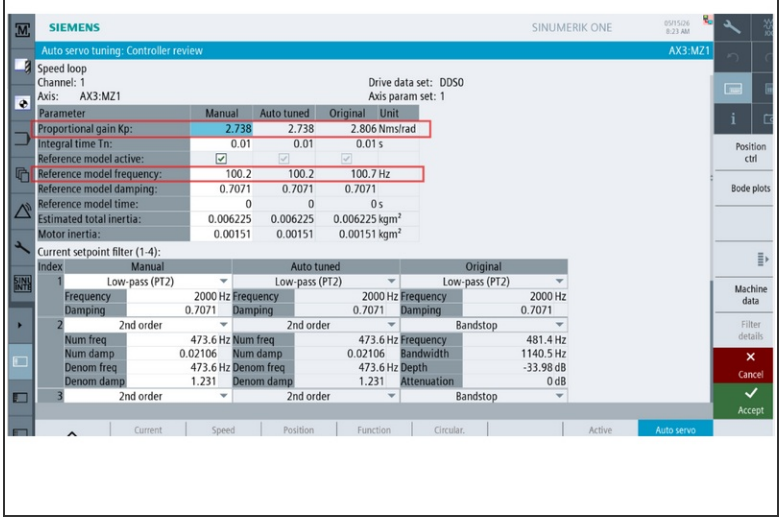
Step 15 — Run Tuning



- Press **[OK]** to open the Auto Servo Tuning: Axis Parking Position screen.
- Press **[OK]** again to start Auto Tuning.
- Follow **Step 10** to run all 4 measurement cycles, then **Step 11** to accept the controller review.

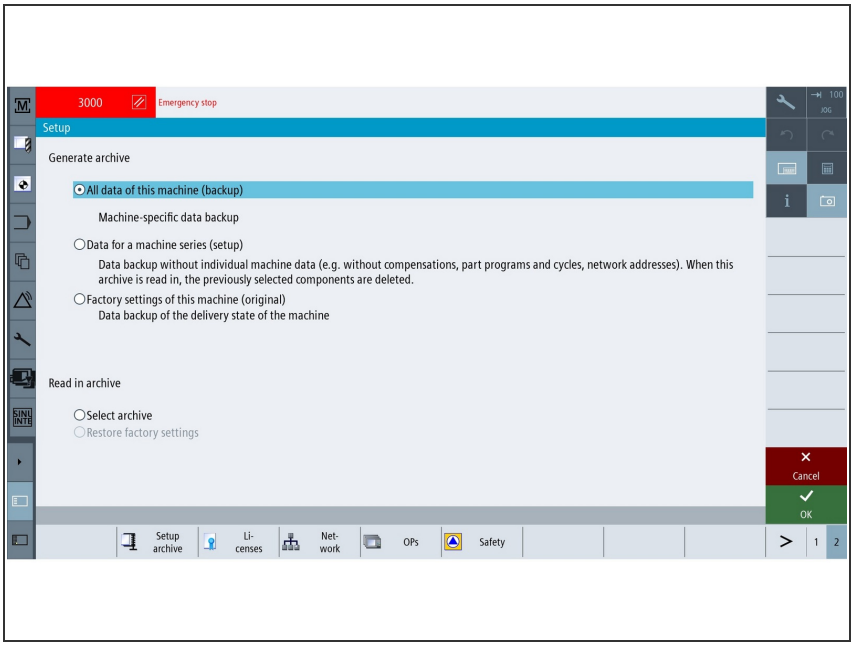
Step 16 — Verify Speed Controller Changes





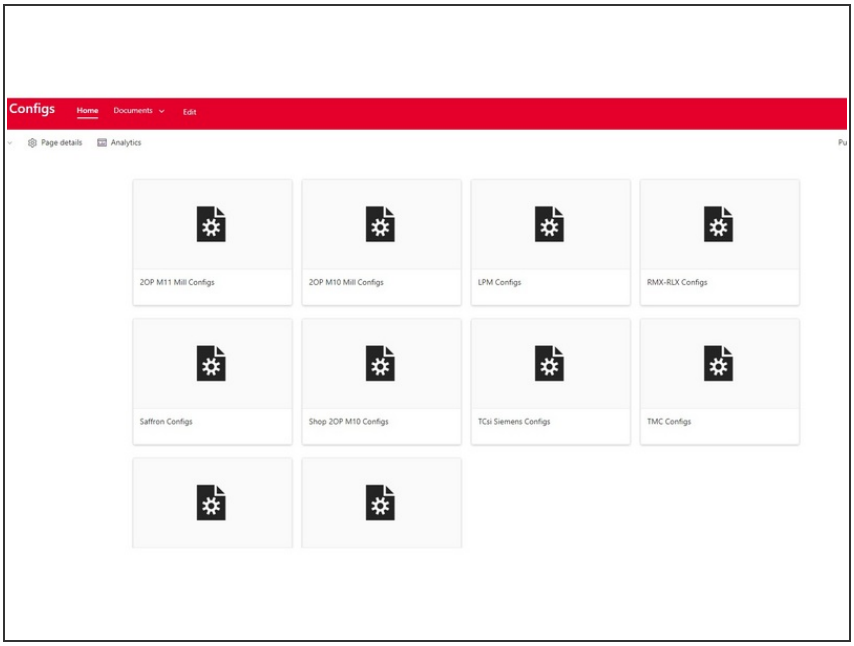
- After tuning completes, the Controller review screen appears.
- Press **[Speed Ctrl]** to view the speed control data changes.
- Review the updated drive data — note the changes to Proportional gain Kp and Reference model frequency.
- Press **[Accept]**, then press **[OK]**.
- Verify: In JOG, move the axis in both directions at low and moderate feed, then stop and let it hold position. Listen for humming at standstill and during motion
- If humming persists after the re-tune, return to **Step 14** and lower Maximum bandwidth by 10 Hz.

Step 17 — Create an Archive file



- Put the machine in E-Stop
- Make a final archive to back up the changed data
  - Archive Current System

Step 18 — Upload Archives to Sharepoint



- Upload both archives from before and after tuning to the Sharepoint Configs Page. Machines are sorted by type and serial number.
- Southwestern Industries Config Directory