This guide obtains just brief information. In case you need detailed instructions, read the OEM manual.

DHR2_RHEOMETER
(Discovery Hybrid Rheometer-2, TA Instruments)

Content

Starting procedure

1. **Turn on the pressure air, and check that the pressure is 2 bar.**

   The pressure air supply is always the first thing to be turned on and the last thing to be turned off!

   The device is equipped with magnetic air bearing to minimize friction. Risk of fatal damage to the instrument in case of insufficient pressure air supply!

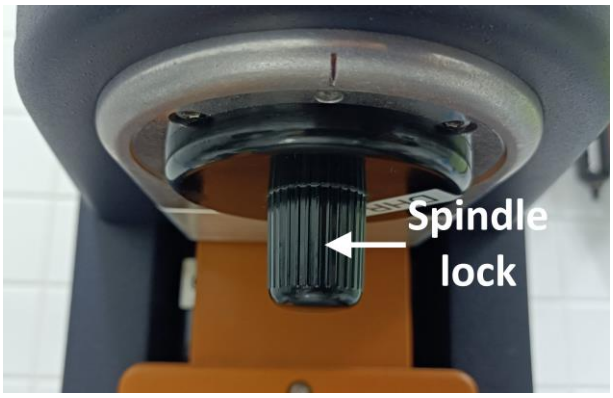
   Do not proceed if the correct pressure is not established.

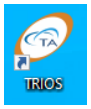
   Check the pressure regularly throughout the measurement. **If it drops below 2 bar, terminate the measurement immediately and, if possible, bring the geometries out of contact.** If the pressure is fully lost while the machine is running, lock the motor with the lock icon on the front panel and contact the guarantor immediately.

2. **If installed, remove the spindle lock.**

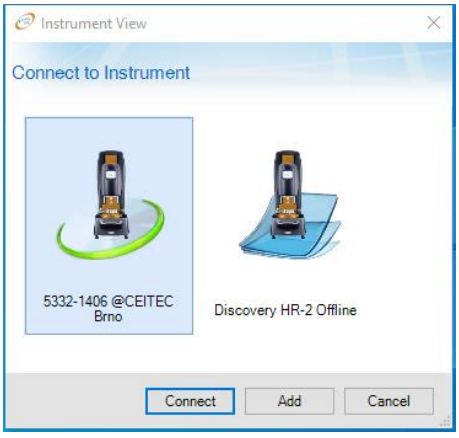
   Hold the spindle lock with one hand and gently turn with the drag rod with your second until the spindle lock is completely unscrewed. Never turn with the spindle lock.
   Spindle lock shall never be installed when the device is turned on! Always remove it before turning on the machine.

Risk of severe damage to the instrument in case of turning on the rheometer with the spindle lock still installed!



3. Turn on the PC, control unit (main switch in the back), and the water circuit pump.
4. Start the TRIOS software using the 

icon, and connect to the DHR2 online instrument.



If the device appears offline even though it is turned on, check if the current IP address (on the rheometer's display) matches the setting in the software (hover the mouse over the instrument, a hint will appear). If not, click on the Add button, select the Instrument type: Discovery HR-2, type in the actual IP address (usually 192.168.0.199 or 192.168.0.200), wait until the Serial number, Name, and Location are automatically loaded, and then press OK. All settings and calibrations will be retained from the device.

NOTE: DHR2 offline could evaluate the data when the rheometer is off. TRIOS is freely available on the TA Instrument's webpage.

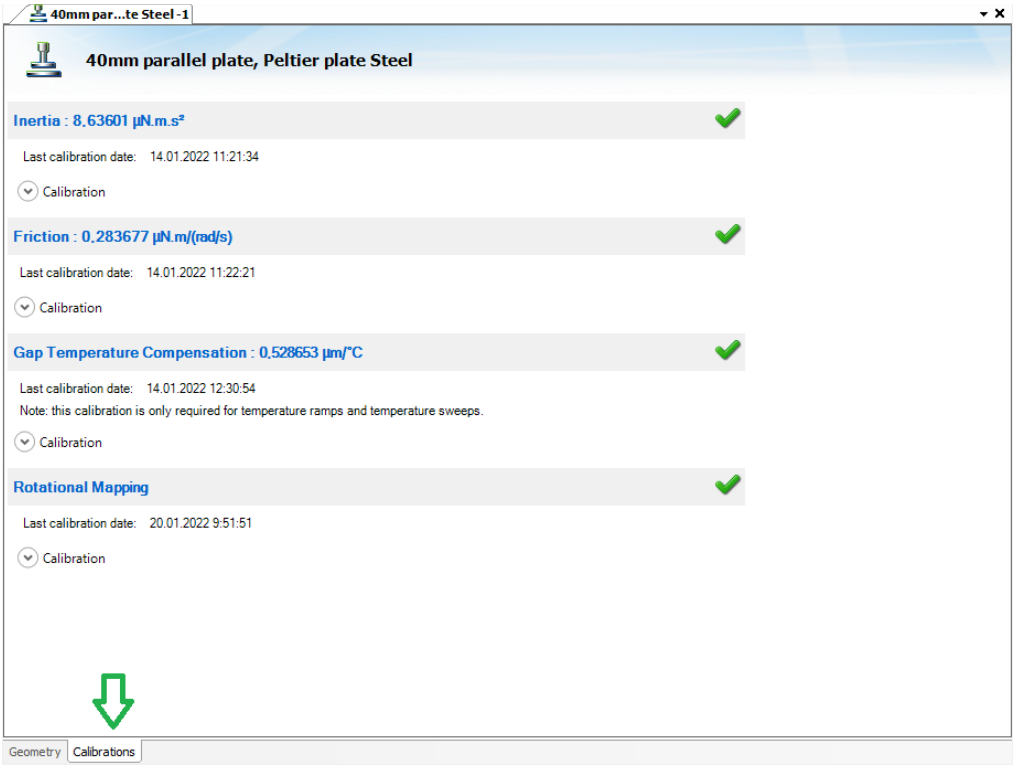
5. Mount the upper geometry.
   a. Check that the machine's status is Idle (on the front display or in the software) and the spindle is freely rotating (i.e., it is not locked).
   b. While idle, carefully hold the spindle by one hand and put on the geometry with the second hand around the shaft to the topmost position. The spindle will be lifted. **Do not use excessive force be either of your hands!**

c. Screw on the geometry by carefully rotating the spindle – never screw the geometry by rotating the geometry itself. Beware of any excessive force applied to the geometry in any direction! **Do not overtighten!**

   Follow the video manual in the DHR2 folder on the CEITEC Nano webpage – link HERE.

d. Select the active geometry in the TRIOS software.
   The active geometry is indicated with a checkmark.

e. Check the validity of all calibrations.
   TRIOS SW -> Geometries panel -> Active geometry -> Calibrations.



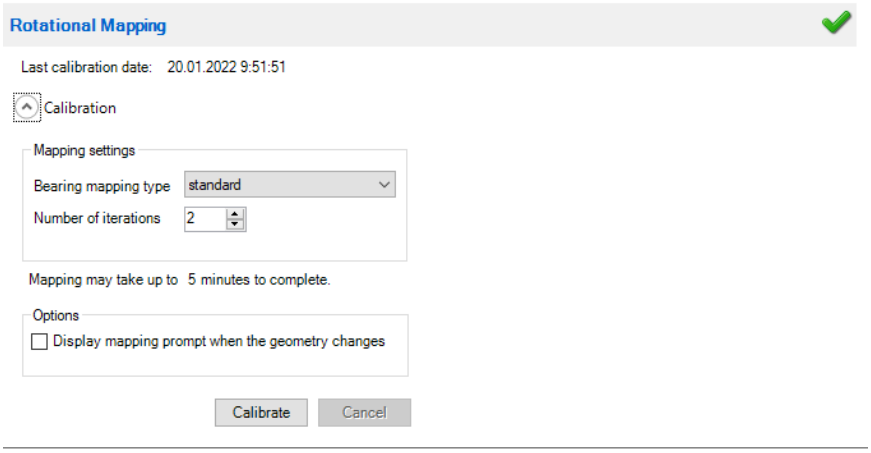
   Renew any outdated calibrations if necessary, or contact the guarantor. NOTE: Gap Temperature Compensation calibration is unnecessary for isothermal measurements but be sure to perform the Zero gap procedure at the final temperature.

f. Run the **rotational mapping** calibration whenever the geometry is reinstalled (even if it is the same geometry as was previously installed).
Go to geometry panel -> select the active geometry -> Calibrations -> Rotational mapping -> Calibration -> Click on Calibrate -> Follow the instructions. Takes ~5 minutes to proceed.

Recommended settings:

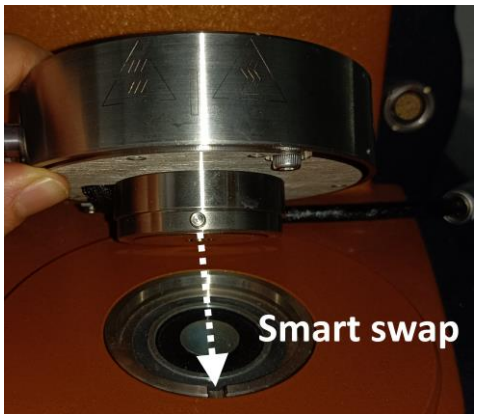
Bearing mapping type: Standard

Number of iterations: 2



6. Mount the lower geometry (if not installed already).
   a. Click on the Smart swap button on the instrument's front panel.
   The smart swap magnet is turned off for a limited time, as indicated by the front panel's green light.

   b. While the green indicator is on, put the geometry in the correct position (pin facing forwards in the opening) on the smart swap magnet.



c. Plugin the connector, red dot facing up.
d. Peltier Plate only: connect the water circuit hoses.

7. Run the zero-gap procedure whenever one of the geometry is reinstalled.
   a. Ensure that both the upper and the lower geometry are installed and selected in the TRIOS software as the active geometries.
   b. Make sure that the geometries are clean.
   c. Bring the rheometer head to close contact (approx. 5-20 mm) using the up/down arrows on the front panel. **Avoid contact between the geometries!**
   d. Go to Gap control panel – Click on the Zero gap icon  .
8. The instrument is ready for use.

Measuring

1. Ensure that the instrument is initiated, calibrated (incl. geometry), and clean.
2. Load the sample.

There are several options how to load the sample. The general requirement is that the sample fully fills the space between the geometries but does not spill to the upper geometry's side edges.

Lock the upper geometry with the lock icon on the front panel. Act gently, **avoid excessive force being applied on the upper geometry!**

Low viscosity samples:

a. Bring the upper geometry to the final gap.
b. Put the sample between the geometries with a pipette. Capillary forces will help distribute the sample over the whole area while not leaking outside.

Medium-high viscosity samples:

a. Raise the upper geometry.
b. Place the sample in the middle of the lower geometry.
c. Slowly approach with the upper geometry until the final gap is reached. As the upper geometry squeezes the sample, **the normal force must not exceed 10 N!**
d. Check the sample edge from all sides.
   If much under-filled, raise the head, add more sample, and repeat step c.
   If slightly under-filled, consider lowering the gap
   If over-filled, trim the sample – carefully remove the excess sample. Do not use **steel tools!** If trimming results in the slightly under-filled sample, lower the gap. Consider setting an appropriate trim-gap offset next time.

Solid samples (to be melted)

a. Cut the samples in the shape of the geometry.

   b. Raise the upper geometry.
   c. Place the sample between the geometries.
   d. Slowly approach with the upper geometry until it touches the sample. **Make sure that the axial force does not exceed 10 N!**
   e. Set the initial temperature of the environmental system to melt the sample.
   f. Trim the sample or adjust the gap to establish correct filling.
3. Set the measuring procedure.
4. Run the experiment.
5. Once the measurement is finished, **raise the head** with the upper geometry.
   Do not exceed the Axial force of +/- 10N! That may happen for highly viscous samples when the head is raised. In that case, proceed slowly and only raise the head in small steps, wait until the axial force is relaxed and then continue. Repeat as many times as necessary until the upper geometry gets free of contact with the sample/lower geometry.

   Gently clean both the upper and the lower geometry with a wet cloth (depending on the sample, it could be water, IPA, or acetone).

   Lock the upper geometry with the lock icon on the front panel. Act gently, **avoid excessive force being applied on the upper geometry!** If necessary, dismount the upper geometry for cleaning.

   Never use steel brushes or other hard tools for cleaning! Only tools from soft materials such as brass, copper, certain plastics, paper cloths, etc., are allowed for cleaning!

   Never use corrosives or abrasives for cleaning!

Turning off

1. Dismount the upper geometry.
   a. **Make sure that the geometry is unlocked and free to spin**.
   b. Raise the head, hold the upper geometry with one hand and gently unscrew the spindle with the second hand. Always rotate the spindle. Never turn with the geometry!
2. For using the optical stage lower geometry, reinstall the Peltier Plate using the smart swap.
   a. Press the smart swap button on the front panel, and unplug the geometry connector while the green light blinks.
   b. Press the smart swap button on the front panel again, remove the geometry while the green light is on.
   c. Install the Peltier plate geometry following step 6 of the initialization procedure.
3. Turn off the SW TRIOS.
4. Turn off the Control unit and the water pump.

5. Install the Spindle lock.

6. Close the pressure air valve.

   The order of steps 4-6 must not be interchanged! Never leave the spindle lock on when the rheometer is running. The pressure air supply is always the first thing to be turned on and the last thing to be turned off!