

IMPORTANT! Operator safety

- Do not place your hand in between the crosshead and the compression plate unless the measurement device is on MODE 0! To operate the clamps, use manual switches located in the clamp body (operator panel does not work in 0 mode).
- In case the machine must be stopped immediately, press the red button on the control panel. To release the button, rotate it clockwise.
- Upper safetylimit is 10 mm for force controlled pulling experiment (e.g. paper creep). It takes more than 10 mm for clamps to stop moving.

General user rules

- Log out after your experiments for all machines.
- If somebody is logged in, you are not allowed kick him out. For example, if you are trying to contact the computer remotely, click "No", when remote desktop asks: "User XYZ is logged in and his session will be closed. Do you want to proceed?"

1 Foreword

This is a list of instructions to bring the Instron measurement device and necessary camera gear on-line and to perform wood fatigue tests. Please read the manual through before attempting to use the equipment. The Instron measurement device contain safety mechanisms to stop the user from harming it. Nonetheless, care should be taken not to drive the crosshead into the sample plate. This can cause damage to the force gauge (rather expensive) in the device.

2 Before you start doing set of experiments

- Reboot windows (clear memory).
- Reboot instron (clear memory).

3 Changing the clamps

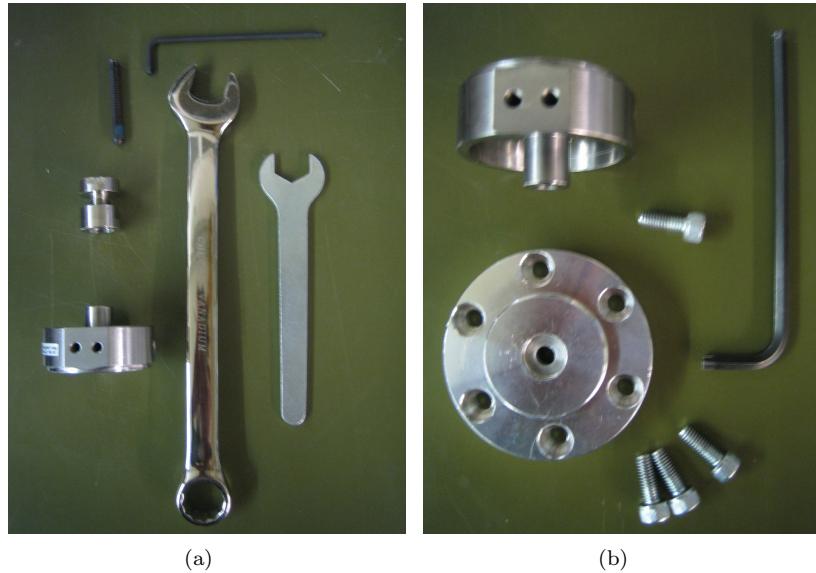
There are more accurate instructions next to the machine, but here is some repetition.

3.1 Basic issues

- ALWAYS MAKE SURE the machine is in MODE 0 before you put your hand between the clamps!!
- Put the used screws etc. into the right boxes. Note that some parts are used in both clamp types.
- You can roughly adjust the distance between the upper and lower part as follows:
 - Set the machine on MODE 0.
 - Roll the black handles on the upper part of the machine open. It opens by rotating counter-clockwise.
 - Move the upper part of machine by pressing the black switch close to the manual control buttons.
 - Close the black handles tightly as you're done.
- Put the tools into their places as you have changed the clamps!

3.2 Compression plates

The parts and tools needed for changing the compression plates are shown in Figure 1



(a)

(b)

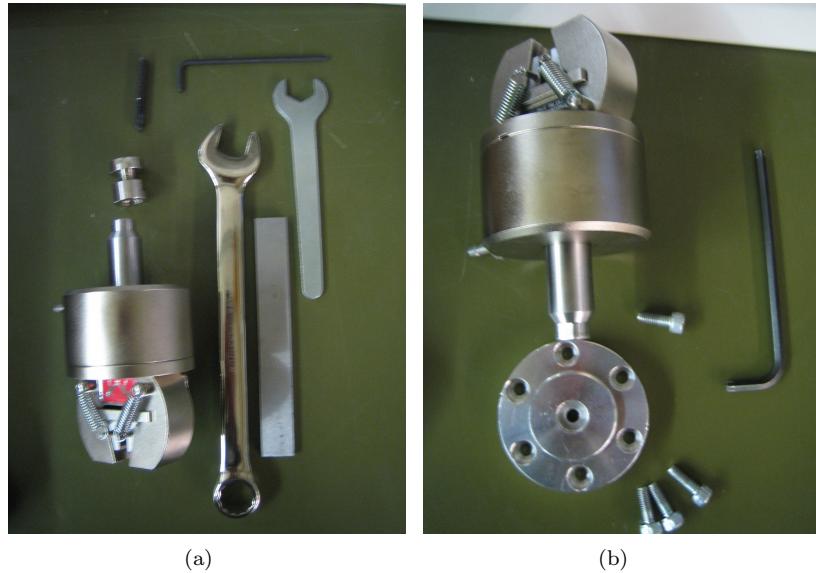
Figure 1: The parts and tools required for upper (left) and lower (right) compression plates.

3.2.1 Removing the compression plates

- Remove the three screws of the round bottom part with six screw holes.
- Remove the screw from the bottom of the structure you recently removed and pull the parts apart.
- Use two wrenches to loosen the tightening part (silvery) at the upper plate.
- Rotate the upper plate in order to remove it. BE CAREFUL, the plate is somewhat heavy and it drops suddenly as the screw is loose enough!
- Use hex head wrench to remove the special screw from the upper plate.
- If you are going to change these plates to the stretching grips, save all the other parts except the compression plates. Put compression plates to their box.

3.2.2 Installing the compression plates

- Take a compression plate and the round bottom part with six screw holes. Put these parts tightly together with a screw.
- Attach the bottom part onto the bottom of the machine by three screws.
- Take the special screw (the black long one that lacks proper head) and another compression plate. Put the screw into the plate.
- Take the tightening part and put it around the screw. Screw the structure onto the upper part of the machine.



(a)

(b)

Figure 2: The parts and tools required for upper (left) and lower (right) stretching grips.

- Tighten the tightening part by two wrenches.
- Adjust the height of the upper plate (see earlier). Then, put the machine on MODE II and, by using arrow buttons, move the plates very close to each others (not touching).
- Use Instron program to calibrate the machine.

3.3 Stretching grips

The parts and tools needed for changing the stretching grips are shown in Figure 2

3.3.1 Removing the stretching grips

- Remove the pneumatic tubes: take a grip on the ring around the head of the tube, push and rotate it.
- Remove the three screws of the round bottom part with six screw holes.
- Remove the screw from the bottom of the structure you recently removed and pull the parts apart. (They are really tight.)
- Use two wrenches to loosen the tightening part (silvery) at the upper grip.
- Rotate the upper grip in order to remove it. BE CAREFUL, the grip is quite heavy and it drops suddenly as the screw is loose enough!
- Use hex head wrench to remove the special screw from the upper grip.

- If you are going to change these grips to the compression plates, save all the other parts except the stretching grips. Put stretching grips to their box.

3.3.2 Installing the stretching grips

There is slightly more details in order to put the grips straight.

- Take a stretching grip and the round bottom part with six screw holes. Set the parts together in the way that the stretching grip is as horizontal compared to the camera as possible. Put these parts together with a screw, tightly.
- Attach the bottom part onto the bottom of the machine by three screws.
- Take the special screw (the black long one that lacks proper head) and another stretching grip. Put the screw into the grip.
- Take the tightening part and put it around the screw. Screw the structure onto the upper part of the machine, but not overly tightly.
- Attach the pneumatic tubes onto the grips (push them hard onto the grip by holding the base of the head of the tube until you hear a snap).
- Take a metal plate and put it into lower grip. Close the grip.
- Lower the upper grip enough to be able to grab the upper part of the metal plate. Close the upper grip. Now, the grips should be straight compared to each others.
- Tighten the tightening part by two wrenches.
- Open the grips and remove the metal plate.

4 Before starting each experiment

- Be sure that the Instron machine is calibrated. For example, in constant strain compression experiments, the force indicator on Instron Computer (second computer from left) should give 0.000 kN in the start.
- If needed, calibrate the machine (advised later in Troubleshooting section).

5 Changing variables

5.1 General issues

- Variables can be changed in tabs in Lumikki.
- **Remember!** Every time you have changed the variables, update them to Lumikki by clicking "Apply" at the end of the variable list!
- You can make creep tests by tensile protocol by changing the channel from 1 to 2 (from position control to force control) and applying the desired creep load (in kN:s) to the ramp amplitude. The ramp rate can be used to control how fast the load is applied onto the sample.

5.2 Creep test

- Go to the TTM tab in Lumikki and change the *protocol name* variable to "creep" (without quotas).
- The only other parameter to change is **load**.
- If you are doing a compression tests, give negative values for the load. If you are doing stretching tests, give positive values.

5.3 Tensile test

- Go to the TTM tab in Lumikki and change the *protocol name* variable to "tensile" (without quotas).
- Make sure the **channel** is on Channel 1: thus, the tensile testing machine obeys position control when moving the clamps.
- Tensile tests are supposed to follow ISO 527-1 standard. This means that the **ramp rates** of the tests should be some of the following:
 - 0.0333 mm/s (aka 2 mm/min, like it stands officially in the standard)
 - 0.0833 mm/s (aka 5 mm/min)
 - 0.1667 mm/s (aka 10 mm/min)
 - 0.3333 mm/s (aka 20 mm/min)
 - 0.8333 mm/s (aka 50 mm/min)
 - 1.6667 mm/s (aka 100 mm/min)
 - 3.3333 mm/s (aka 200 mm/min)
 - 8.3333 mm/s (aka 500 mm/min)
- In the standard, there is also 1 mm/min, but it is too slow for our machine.
- Make sure that the **ramp amplitude** is large enough: for example, with the wood samples, it should be bigger than the height of the sample to make sure the machine really compresses it enough.
- If you are doing a compression tests, give negative values to the ramp rate and the ramp amplitude. If you are doing stretching tests, give positive values.

6 Checking that the camera takes good images

- Go to the Camera Computer (first computer from right) and open program called Measurement & Automation Explorer.
- Choose from side bar menu: My System → Devices and Interfaces → NI-IMAQdx Devices → cam0: DALSA Genie HM1024.
- Then, click button "Grab". Now, you should see a real-time video image of the clamps/compression plates of the machine.

- With the "video", you can check if the camera takes proper images, the sample piece is set straight, etc.
- Close the camera program before starting an experiment! (You can do it by returning to NI-IMAQdx Devices by clicking it.) Otherwise, the camera computer can't save the images during the experiment.

7 Putting the sample to the machine

- Set the machine on MODE I, and move the clamps enough for setting the sample piece right.
- Then, *set the machine on MODE 0*, to be sure that the clamps/compression plates are not moving (onto your fingers) when you operate with the sample.
- Put the sample to the clamps/on the compression plate and check that the camera image looks clear. Adjust lights, camera lenses, position of the sample etc. if needed.
- After all looks clear, switch the machine again on MODE II.

In some wood compression experiments, you can also put around the sample black cardboard pieces (next to the machine or in the shelf in the neighboring room) to avoid the pieces of explosively shattered samples from flying all over the laboratory. The samples rarely break down in that way, but it is easier to collect the pieces if it happens. Samples with vertical annual ring position are in greatest risk to do this.

8 Initial straightening/pinching of the sample

- Go to the Instron Computer and check that the Specimen Protect button is on. The button can be recognized by shield image that turns green when Specimen Protect is on.
- Then, go to the machine and move the clamps/plates in the way that either the sample paper gets straightened or the sample wood piece gets pinched between the compression plates. Specimen Protect makes sure that the sample doesn't get ripped or compressed too much, but the sample is just adjusted to stay in place.

9 Just before starting the experiment itself

- Turn off the Specimen Protect from the Instron Computer AND the Measurement & Automation Explorer from the Camera Computer.* If the latter one asks about saving, click "No".
- Then, go to Lumikki Computer (first computer from left) and open its control tab from web browser. Name your experiment to the text field of the front page.

- Then, *click button "Force status"*, to make sure that all parts of the experiment machine are ready to measure.

10 Starting the experiment

- Once the "Force status" button tells that the whole experiment machine is ready for measurement, click "Run".
- Now the experiment starts, and you can follow the stress-strain curve from the Instron Computer, in LabVIEW window called startLogging.poller.
- As the load/height limit trips, the machine tells you about that. Click "Stop" in Lumikki.

11 After experiments

- Make sure that the machine isn't gathering data anymore. In other words, click button "Stop" after each experiment, especially the last one. Otherwise, the experiment setting continues gathering data after you have left, which may eventually fulfill the data storage of the computers.
- Put the machine to (analog) position control.

12 Instron initialization

First, before anything else is done with the measurement device, it must be initialized properly. In the case of compression tests, the measurement device must be configured so that the crosshead does not reach the sample plate when fully extended. Also setting proper safety limits and calibration are necessary.

To begin turn on the measurement device. The power switch is on the back side of the gray box next to the concrete table. The device boots up for a while and remains in **MODE 0**, until at some point it can be switched to **MODE I**. The device itself does not give any signal about this. but if you watch the log on the TTM machine, you will notice activity when the measurement device is ready to be switched to **MODE I**.

While the machine is booting up, check logs from the *Instron control program* to see when the machine was used last. If you are confident that the machine was last used for the same measurement and has been initialized already, you can skip the rest of this section and set the machine on **MODE I**.

1. Set machine to **MODE I**.

- Clear all safety limits.
- Loosen the two black screw bolts. When open, the handles are to be set downwards (as if they were valves). When closed, the handles point inwards or toward each other.
- Lift the machine using the black rocker switch enough so that you can fully extend the crosshead.
- Using the arrow buttons on the remote, extend the driver head fully taking caution not to allow the driver head to touch the sample pedestal.
- Using the black rocking switch, bring down the machine slowly until there is only a small gap (about 0.5 mm) between the driver head and the compression plate. **Take care not to ram the driver head into the compression plate!**
- Secure the machine by tightening the screw bolts. Leave the handles pointing towards each other.

2. Switch the machine to **MODE II**.

- Calibrate the force sensor by opening the force tab, clicking “Calibration” and then “Balance”.
- Set force safety limits to **±1000 N**.
- Set digital position to zero by opening digital position tab, clicking “Calibration” and then “Balance”.
- Set position safety limits to **±30 mm**. To do this, you must set Instron to **MODE 1** and move the crosshead up a bit, as the crosshead is below the **-30 mm** safety limit at this point.

13 FAQ

13.1 How can I calibrate the force and position meters?

- Open the Instron panel and choose either Position or Load tab, depending on which you want to calibrate.
- Here, open Primary Limits section from side menu, and take the ticks away from parts "Limit enabled" and "Limit tripped".
- Turn Specimen Protect off.
- Open Calibration section and click "Balance".
- Go back to Primary Limits section and put ticks back to "Limit enabled" and "Limit tripped". If needed, turn Specimen Protect on.

13.2 I have a problem with the Instron Computer, how can I restart it?

- Close all programs.
- Restart the computer normally.
- Open the Instron Console and wait that its panel stops flashing or turns green.
- Open LabVIEW from Start menu and choose there lumikkiInterface. Open and activate all windows that end with ".poller".
- Go to the Instron Console panel, then its tabs Position and Load. Go to Primary Limits section and put ticks to "Limit enabled" and "Limit tripped" in both tabs.

13.3 I accidentally forgot to click "Stop" after my last experiment, and the computers continued data unnecessary gathering all the night. What should I do?

- Delete the experimental stress/strain data of the over-long experiment from the Instron Computer and corresponding pictures from the Camera Computer to free memory.
- Restart the Instron Computer and open necessary LabVIEW programs (see the previous question).