

## Manual

### Gehman Tester ET02-II

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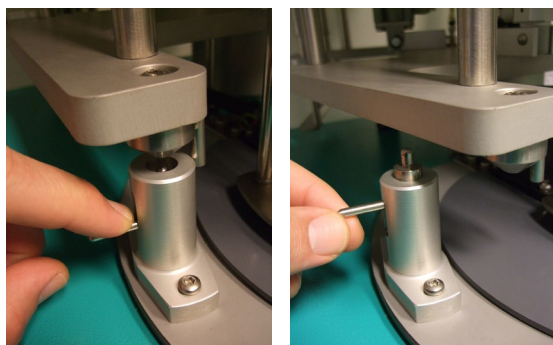
**Technical documentation supplied on USB flash drive**

# Addition

## Combined TR, Gehman and Brittleness Tester

When using our combined instrument there are some things that needs to be done before starting the test.

- Change the rig manually by turning it clockwise or anti clockwise and lock it with the locking device.



- Change to the right method (TR , Gehman or Brittleness) in the software under “edit” and “method”.

This manual continues to describe the Gehman Tester only.  
For other instruments, please refer to the manual for each instrument.



## Technical specification for combined instrument

- Width, mm: 750 (connection of liquid nitrogen on the left side requires free space)
- Height, mm: 1610
- Depth, mm: 870
- Weight, kg: 116 (Combination ET01-II/ET02-II)

## 0. Use

Instrument to determine the relative stiffness characteristics of vulcanized or thermoplastic rubbers, also called the Gehman procedure. The test is done according to ISO 1432, ASTM D1053 method A, or technical equivalent standards.

## 1. Installation of the Gehman Tester

### 1.1 Unpacking

Unpack the instrument carefully. The following items are included:

- Gehman Tester with rig.
- This manual.
- 6 metal guides, one for each station (also transport protection).
- 2 cables (one data cable and one power cord).
- One USB flash drive with Freezing software, this manual in PDF format, and a unique calibration and license file.
- Cryogenic vessel for liquid nitrogen and hose for connection to the Gehman Tester (optional).

**Note:** Remove the metal guides from each station and attach the clamping device instead, see figure 1.1. Save the guides, as they are needed when changing torsion wires.



Figure 1.1

## 1.2 Installation

If the main plug does not fit your outlet, cut the cable and replace with a suitable grounded plug. The cable colours means: Brown = live, Blue = neutral and Yellow/Green = ground. This change should be done by an authorized person.

**Note:** Remember to compare the outlet voltage and the voltage labeled on the instrument. It is entirely the users responsibility that the instrument is connected to the correct voltage.

Place the Gehman Tester and the computer on a stable and horizontal bench.

Connect the following:

- Connect the Gehman Tester to a grounded mains outlet, according to the type label on the Gehman Tester.
- Connect the Gehman Tester to an air supply with a filter and water trap of min/max 7/8 Bar pressure. Connect a dia 10 mm reinforced air hose, see figure 1.2.
- Connect the Ethernet cable between Gehman Tester and the computer's LAN connection. See chapter 2.1.

If the automatic cooling system is supplied, connect the Cryogenic vessel to the Gehman Tester with the supplied flexible metal hose by connecting the hose end to “Liquid Nitrogen inlet” on the Gehman Tester.

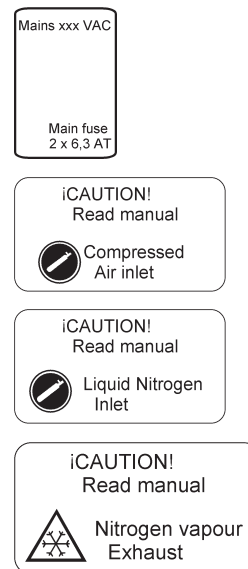
Also connect a silicone hose to the “Nitrogen Vapour Exhaust” connector. This hose should not be longer than 5 m and the open end must be connected to a fume hood or directly to an outdoor environment.

**Note:** It is of great importance that all waste gas are led out from the “vapour exhaust” connector at the backside of the Gehman Tester to an outdoor environment. This is to prevent high concentration of nitrogen gas in the room.

- To connect a printer, see the manual for the printer.



Figure 1.2



## 2. Freezing software

### 2.1 Installation

#### LAN settings

The Gehman Tester uses IPv4, which is an addressing system of communication by Ethernet.

For proper communication between the Gehman Tester and the PC the connection must be set correctly according to how the Gehman Tester is connected. Follow the right options below.

Local connection is preferable to avoid communication problems, when using the instrument, if the network is down.

**Local connection** (cable connection between the computer and the instrument):

Go to the network settings in Windows and select the local connection that is connected to Gehman Tester. If your computer only has one LAN port, there is only a local connection, see figure 2.1a.

Right-click the icon and select “Properties”.

When the properties comes up, highlight the “Internet Protocol Version 4 (TCP / IPv4)” and press the “Properties” button, see figure 2.1b.

Then select the option “Use the following IP address”.

Enter the IP address 192.168.10.90

Subnet Mask will be filled in automatically to 255.255.255.0, see figure 2.1c.

**LAN connection** (connecting instrument to a LAN with dynamically assigned or fixed IP numbers)

The computer and Gehman Tester must be adapted to the network by a network administrator to avoid address conflict.

The Gehman Tester comes with the following settings. Specify this for a network administrator to connect the equipment in the network:

IP 192.168.10.250

Subnet Mask 255.255.255.0

Gateway 192.168.10.3

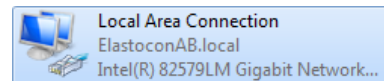


Figure 2.1a

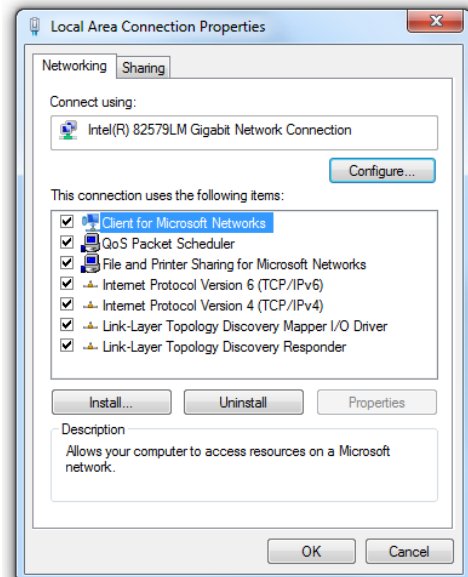


Figure 2.1b

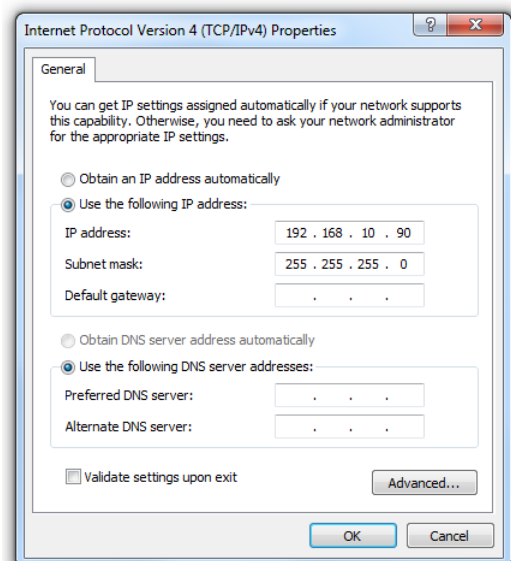


Figure 2.1c

## Install the Freezing software (if not already pre-installed)

1. Insert the USB flash drive in an empty USB port.  
Go to Windows Explorer select the file “start.exe”.
2. Next to the “Install Programs” button select “Freezing” and then press  
the “Install Programs” to install the program.

The program and other files will be installed in the application directory Elastocon Freezing along with calibration data.

A working directory will be created with the path Elastocon Data\Gehman Data).

The program’s settings will be stored in the system directories for Windows.

## 2.2 Install calibration file

Launch the software *Freezing*.

If no calibration file has been installed, a new window will appear on the screen.

The window will ask the operator for a calibration file (\*.cal). This calibration file contains both all necessary calibration data for all the stations and the product license information.

The calibration file can be found on the installation USB flash drive. Insert the *Freezing* installation USB flash drive, if not yet loaded. Having the window “Install calibration file” on the screen, browse to the folder “Calibration profile” on the installation USB flash drive. There is only one file stored in this folder and the file name is unique for your company.

Select the calibration file with the unique filename and press the button “Open”.

The software *Freezing* will now launch and your company profile and calibration will be loaded.

If the software is to be used for demonstration purpose only, simply click on the button “Abort”. The software will now enter a demo mode. The program will not attempt to communicate with the instrument in demo mode.

To re-establish communication with the instrument, go to the “Edit” menu and select “Communication Preferences”.

See label on the instrument next to the Ethernet connection for proper communication settings.

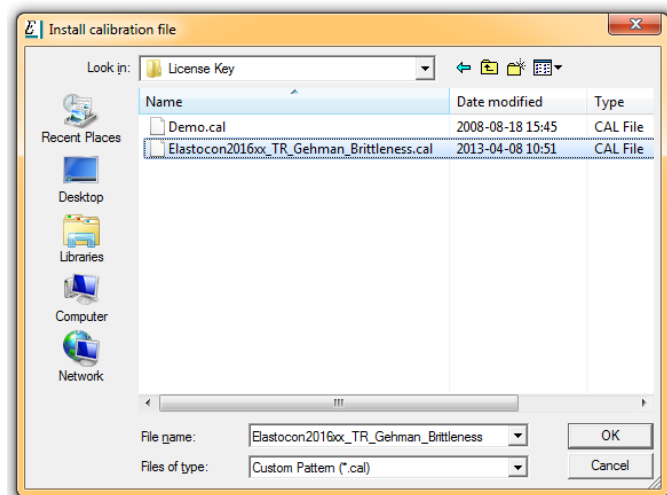


Figure 2.2



## 2.2.1 Change calibration profile

The instrument needs to be calibrated annually. If the calibration deviates too much from any calibration instrument used, a correction must be made.

The current calibration file can be loaded into in a calibration software and the calibration can be adjusted. This software can be found on the installation USB flash drive and can be launched directly from the USB flash drive (FrezCal.exe).

In the software *FrezCal* the license/calibration file can be opened for adjustment.

The calibration file can be found in the Windows software directory Elastocon Freezing and subdirectory Cal.

When the adjustments are finished, the file must be stored with a new file name.

A typical calibration file name is built up as follow:

<Company name YYMMDD Gehman.cal>

Where YYMMDD is the actual calibration date. Ex. File name would be: Elastocon AB 20160101 Gehman.cal

It is very important that the new calibration file is stored in the same folder as the current.

The new file must now be loaded in the *Freezing* software to be able to work.

Launch the software *Freezing* and click with the left mouse button on the tag “Calibration”, see figure 2.2.1a.

Press the “Browse” button.

Select the new calibration file you have created and press the “Save” button, see figure 2.2.1b.

When the dialogue “Reload?” comes up, select the “Yes” button.

The software will now inform you that you have selected a new profile, see figure 2.2.1b.

Restart the software and make sure that your profile is shown on the “splash screen”, see figure 2.2.1c.

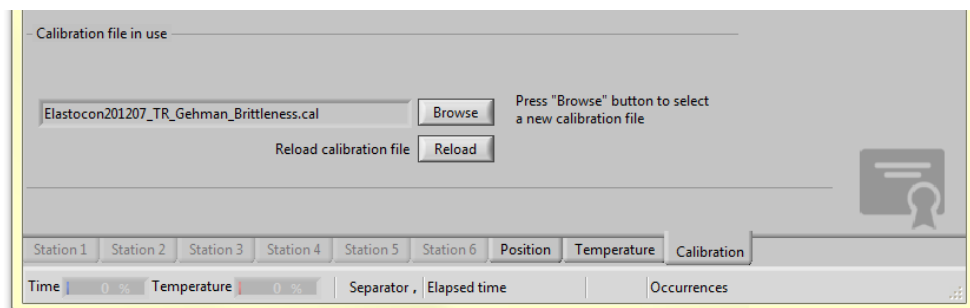


Figure 2.2.1a

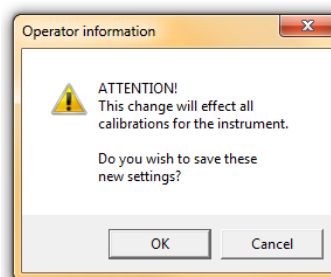


Figure 2.2.1b



Figure 2.2.1c

## 2.3 Software commands and settings

### File menu (Alt+A) figure 2.3a

**New** = Start a new measurement (Ctrl+N).

**Open** = Open an old measurement (Ctrl+O).

**Close** = Close a measurement file.

**Print test results** = Printing of the report. Prints both the RM-values and the graph.

**EXIT** = Ends the Freezing software (Ctrl+Q).

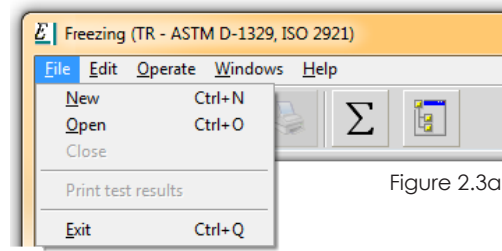


Figure 2.3a

### Edit menu (Alt+E) figure 2.3b

**Method** = Set TR or Gehman standard method (if available).

**Calculations** = Select the RM-values you want to evaluate from the test data. On historical data you can change this to evaluate other RM-values. Calculations can also be inserted, eg 70-10 (Ctrl+C).

See chapter 2.4.

**Communication Centre** = Set the communication between the controller and the computer. Can also be used to tune the communication between the Gehman Tester and computer.

**Working directory** = Change the path to the test files (Ctrl+W).

**Save setup** = Save pre-settings to a disk (Ctrl + Shift + S).

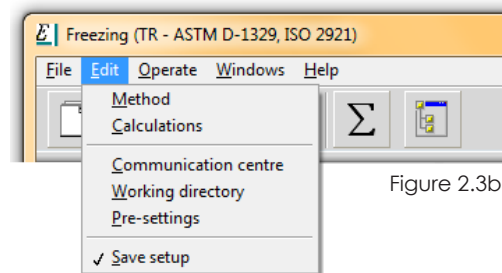


Figure 2.3b

### Operate menu (Alt+O) figure 2.3c

**Start measurements** = Start a measurement initiated with new (Ctrl+S).

**Abort measurement** = Abort running test (s).

**Turn all stations to full angle** = Turns all stations 180°.

**Return all stations to Zero** = Turns all stations to the 0° position.

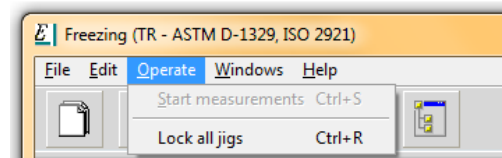


Figure 2.3c

### Windows menu (Alt+W) figure 2.3d

**Full size** = Maximize *Freezing* software on screen. (Ctrl + /).

**Diagram settings** = Adjust diagram settings.

**Reverse axis** = Reverse the x and y diagram axis.

**Current axis range** = Set axis range to stored values (Ctrl+U).

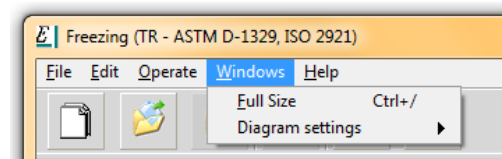


Figure 2.3d

### Help menu (Alt+H) figure 2.3e

**About** = Information about the software, version etc. Tip strips will also appear on mouse events and is context sensitive.

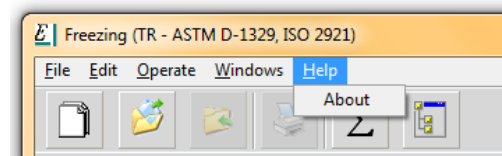


Figure 2.3e



## 2.4 Calculations

Go to the “Edit” menu and select “Calculations”, see figure 2.4.

### RM Editor

Select the RM data if you would like to evaluate. RM Editor shows the present values for evaluation.

#### To add a new RM value:

Enter the new value in the “New value” box and press the button “Add” or press the [F3] key on your keyboard.

#### To replace a RM value in the “RM Editor” list:

Enter the new value in the “New value” box and click with the left mouse button on any value in the “RM editor” list. The list value should be marked in blue or black.

Then press the button “Replace” or press the [F2] key on your keyboard.

#### To remove a present value from the “RM Editor” list:

Click with the left mouse button on any value. It is possible to hold the Shift key pressed while selecting one or several values. The value(s) should be marked in blue or black.

Then press the button “Remove” or press the [F4] key on your keyboard.

#### To add a RM constant to the arithmetic function:

Mark any value in the “RM editor” and press the button “Constant” or press the [F5] key on your keyboard.

### Arithmetic function

Make a calculation with the RM values in the “RM Editor”. Values within “-signs are RM constants. It is then possible to make a mathematic expression in the “Arithmetic function” field. You can also describe the expression with a name in the “Header” field (max 8 chr).

**Here is an example:** You wish to make the calculation of RM2 - RM10

The expression should look like this:

(“2” - “10”)

To add this calculation to the report, simply click with the mouse on the radio button next to the “Arithmetic function”. The function will be shown in the preview field above.

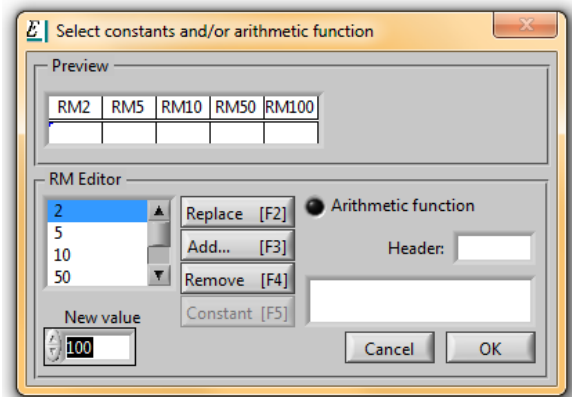


Figure 2.4

### 3. Using the Gehman Tester

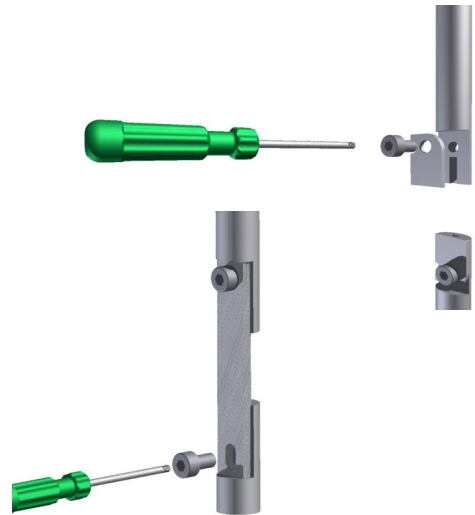
Switch on the power to the Gehman Tester and the computer (in this order). The touch display will make a self test and then show the temperature in the bath. The process value is in red. Start the software *Elastocon Freezing*.

If no error messages shows up in the software, continue with 3.1.

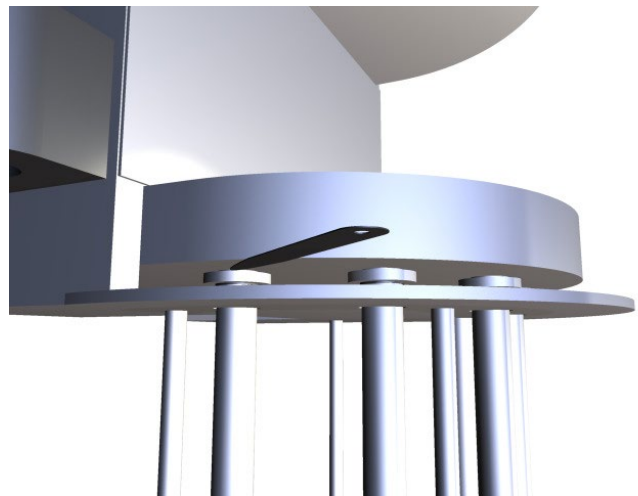
#### 3.1 Preparations for testing

##### 3.1.1 Mounting the Torsion wires

1. Remove the 2 plates that normally fix the rubber sample during tests. Remove upper and lower plates.
2. Insert the 0° aluminium template where the rubber sample normally fits. Insert both screws, but do NOT tighten the screws. The template must remain free to move.



3. Put the 0.25 mm feeler gauge between the lower air bearing gap.
4. Make sure the upper rod and the lower clamp is in parallel. Push the upper rod upward, so the feeler gauge is being pressed and tighten the 2 screws on the aluminum template. Make sure the rod stays in the upper position, by friction.
5. Put in the torsional wire from the top trough the upper mechanical part of the rig and down to the rod.



6. Hold and vertically center the wire, so that the wire fits for both upper and lower setscrew. Different wires can have different length.
7. Tighten the lower setscrew on the wire.
8. Pull the torsional wire gently upwards and tighten the upper setscrew.

**IMPORTANT!** Make sure not to twist the wire when tightening. Just pull the wire straight up.

9. Take out the feeler gauge. Make sure that the rod has not moved down. The feeler gauge distance must remain.
10. Press the pre-set button in the software and make sure the value is being pre-set to 0.

11. Remove the aluminium template. Look at the position in the software as the template has been removed. A small deviation from 0° angle is acceptable. About 5°. Any higher deviation must be corrected and the procedure must be repeated.
12. Perform a full twist from the software (menu: Operate – Turn all stations to full angle). Make sure that the rod is hanging freely (floating on air). There must be no friction either in 0° position or at full angle twist. The air will flow for about 10 seconds after the stations have been returned to zero. Check for friction at 0° point, during this time.
13. Turn back the rod and make sure to get a position close to the same angle in point 11.

**Note:** When performing the friction test in air, the rod can start to oscillate and when the airflow is cut off the rod will be blocked in any interval of the oscillation amplitude. It is then recommended to stop any oscillation by hand, before the airflow is cut off (within 10 sec).

Rubber sample and liquid will slow down any oscillation during tests.

14. Repeat the same procedure for all wire changes.

### 3.1.2 Fill the container with cooling liquid

When the rig is in the upper position, fill the container with a suitable liquid (e.g. ethanol). Add room tempered cooling liquid (eg. 18 °C/65 °F) up to min/max 50/60 mm from the top of the container and check that the circulation pump works properly when the Gehman Tester is switched on.

**Note:** Evaporation and the cooling will decrease the liquid level during the test. Therefore check the level before each test and add additional liquid if required.

Always keep the level at 50–60 mm at room temperature (approx. 18–20° C/65–68 °F). A hint is to look on the red display on the Gehman Tester while pouring the liquid into the container. This display shows the actual temperature. For chilled ethanol the tolerance of the liquid level is 70–80 mm at approx. -80 °C/-112°F.

### 3.1.3 Cooling of the liquid

If manual cooling is used (carbon dioxide) set the controller to -100 °C in the software from the tag "temperature", see figure 3.1.3. This is to avoid heating during the cooling.

**Note:** If carbon dioxide ice is used, crush it well and do not add too much, as this may delay the heating.

If automatic cooling with liquid nitrogen is used (option), set the controller to the start temperature, e.g. -73 °C.

**Note:** After a test the Gehman Tester will automatically start to cool down to the set start temperature. See the Edit menu and the tag "temperature" for other settings. The communication with the computer is still active even if the cooling is shut off.

Start the cooling for -73 or -75 °C, guidance can be found in ISO 3383. Normally crushed dry ice (solid carbon dioxide) or liquid nitrogen is used. Liquid nitrogen is used with the automatic cooling system, through a cooling coil inside the bath.

If pre-cooled Ethanol is used, fill the bath as close as possible to test start. Make sure you will not fill more liquid than up to approx. 80 mm from the top.

Apply a pressure on the cryogenic vessel to get the liquid nitrogen into the Gehman Tester. This can be done by using a self-pressurizing cryogenic vessel or by connecting dry nitrogen gas to the vessel with a pressure of about 0.8–1.5 Bar (8–15 psi).

**Note:** Have the rig raised during the cooling period to avoid ice formation on the rods.

#### Hints for using Gehman Tester without the automatic cooling system.

1. Prepare the test by mounting test pieces in the test stations and create new measurement files for each of the test stations in the *Freezing* software.
2. Set the temperature to -100 °C.
3. To improve the cooling, pour about 2–3 liters pre-cooled liquid (-80 °C) into the container and leave the liquid for about 5 minutes.  
Drain the liquid again from the container and fill up with new pre-cooled liquid to the correct level.
4. Make sure that the rods are locked, but that the test station's locking caps are under the locking pins.
5. Stretch the test pieces for elongation, start the measurement and immediately lower the rig in the liquid.

The test time will start counting down and the test starts automatically.

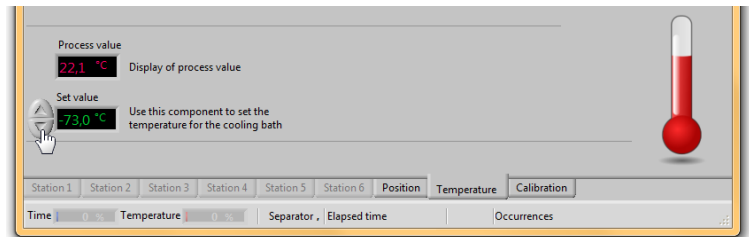


Figure 3.1.3

## 3.2 Starting a test

### 3.2.1 Initializing a test

Mount the test pieces in the clamps. Be careful and do not press too much on the upper clamp, since this may damage the rod. The best way is to hold the upper clamp steady with one hand and mount the test piece with the other hand. Do not use any sharp item to press the test piece since this may damage the wedge, see figure 3.2.1a.

#### How to use the template for a 25 mm free sample length

A steel pin of approx.  $15 \times 1,5$  mm tied on to a nylon string will be found in the package for the Gehman tester. This pin is used on the lower clamping device to achieve a 25 mm free hanging length for the mounted test piece.

See figure 3.2.1b.

**1 Small allen screw** to adjust clamping force.

Use the screw driver from the package.

**2 Upper clamping rod.**

**Locker plate** with M4 allen screw. Use the screw driver from the package.

**3 Lower clamping device** is a part movable up and down.

**4 Insert the steel pin** under the lower clamp to achieve a free length for the test piece of approx. 25 mm.

1. Begin with station 1 and mount the test piece into the upper clamping rod and secure it with the locker plate. Begin with station 1 and move on to the next station. Mount and secure all the samples in the upper clamp first.
2. Now begin with station 1 again and pull up its lower clamping device slightly and insert the  $15 \times 1,5$  mm steel pin in the opening that creates for the lower clamp.
3. Now mount the test piece into its lower clamping and secure it with the locker plate. Then remove the steel pin from the lower clamp.
4. Now perform the same procedure on each test stations.
5. Use the small allen key on the 3 mm allen screw on each upper and lower locker plate to adjust the clamping force.

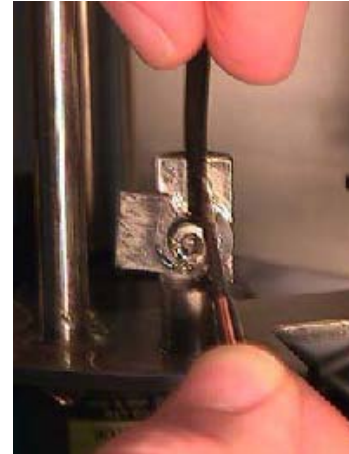


Figure 3.2.1a

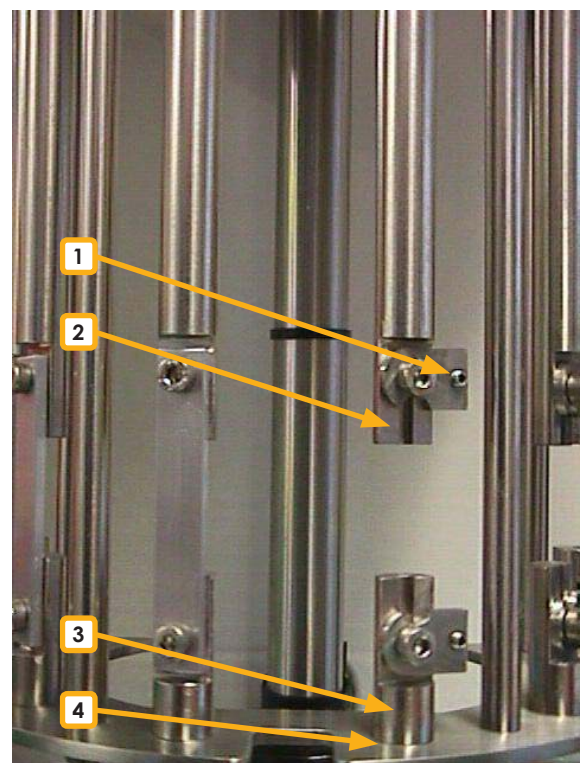


Figure 3.2.1b

In the *Freezing* software, select “New” in the “File” menu. Fill in a file name for your test (you have to give every test piece a unique file name), see figure 3.2.1c.

Then press the button “Save”. A new dialog box appears where you fill in the test data.

## Identification

First give your test a name in “Sample ID” and then eventually some comments in the note field, see figure 3.2.1d.

## Station selection

Choose a test station with a click of the mouse. Test station 1 is the one to the left on the rig.

## End conditions

Choose the test ending conditions by a clicking on the button at the corresponding end condition (Time, Temperature etc.) e.g. RM2. More than one condition can be chosen. The first condition met will end the test for this station.

## Torsional wire

Choose the torsion wire under “torsional wire” (e.g. 2.8 mNm). Can be different for each station. The listed values are real calibration values.

## Sample dimensions

Type in the sample dimensions. Length, width and thickness. Create new measurements for all stations required. You may use from one up to six stations in the same test procedure.

### 3.2.2 Test at 23 °C

To start a measurement at 23 °C go to the “Operate” menu and choose “Start measurements”, or press Ctrl+S. An extra setting for 23 °C appears.

Select test in air or in liquid, see figure 3.2.2a.

Select the kind of test preferred. The instrument automatically finds the zero position for the test pieces when the text “System is ready, test continued” shows up, move on to “the 23 °C test in air, the 23 °C test in liquid”. This will be shown as a flashing text. Do nothing until the flashing stops.

#### The 23 °C test in air

Have the rig raised. Measure the air temperature close to the test pieces and type the result in the box “Air temperature for 23 °C test”. Change the “Data acquisition delay” e.g. 10 second and/or “Additional time for twist motion” e.g. 1 second, if necessary. Press the button “Continue”. The 23 °C test will now start. The “data acquisition delay” time is now counting down (not shown on screen) to zero. Continue on chapter “Save or resume 23 °C test”.

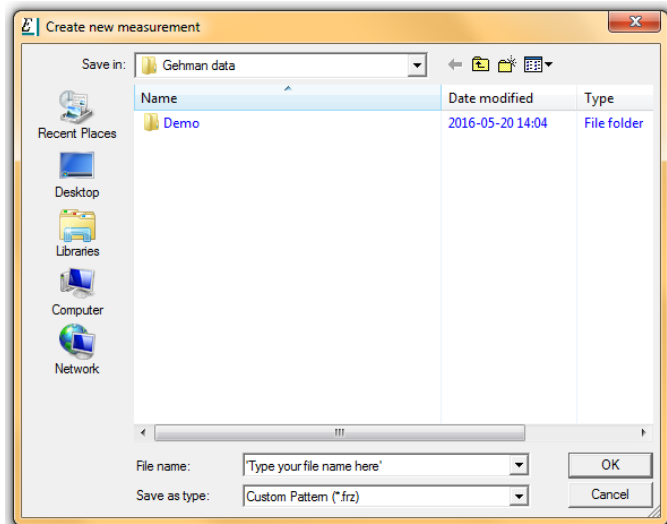


Figure 3.2.1c

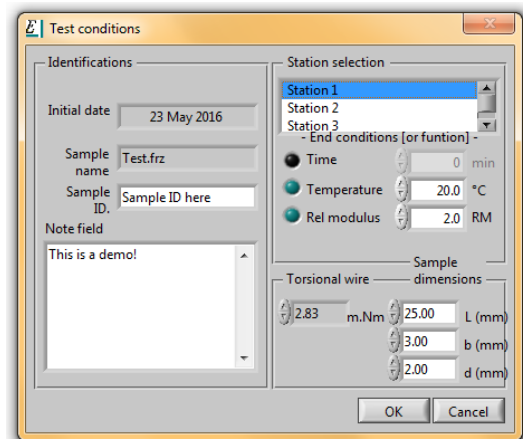


Figure 3.2.1d

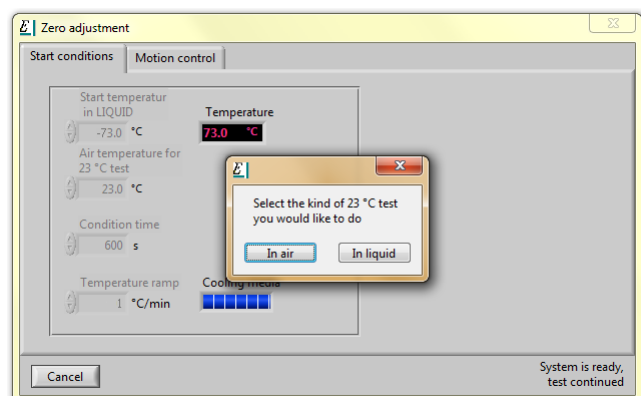


Figure 3.2.2a



### The 23 °C test in liquid

Have the rig raised. Manually type the start temperature in the box “Start temperature for LIQUID 23 °C test”. Change the “Data acquisition delay” e.g. 10 second and/or “Additional time for twist motion” e.g. 1 second, if necessary.

The label of process temperature will change to “lower rig now” when the temperature has reached the preset temperature. Lower the rig and the 23 °C test will now start. The “data acquisition delay” time is now counting down (not shown on screen) to zero.

#### Save or resume 23 °C test.

A new dialog box appears after the data acquisition delay, see figure 3.2.2c.

The dialog shows two options, “Save to file” and “Resume”. It also has the possibility to change torsion wire. An information box tells you if the test was within range. The “Resume” button will be lit if the test is out of range (120–170°). To re-measure this station, select a new torsion wire and press “Resume”, else press “Save to file”.

However it is possible to press “Save to file” even if the test is out of range, but this is not according to the Gehman standard. If more than one station is activated (Initialized) a new dialog box appears. Follow the same procedure as previously in the text. This procedure will continue until all “initialized” stations are approved with “Save to file”. Stations discarded with “Resume” button will result in a new dialog box telling you to change torsion wire. See figure 3.2.2d.

**Note:** If any station was out of range, do nothing before the text below has been read.

The numbers of each station corresponds to the numbers listed in the dialog box. Change these wires and THEN press OK. Follow procedure in chapter 3.1.1 It is important NOT to press the OK button until all wires are replaced and tightened correctly. After this procedure the instrument will make a self test and readjust the zero position for the stations resumed. When the adjustment is complete a new 23 °C test will be done immediately.

The “resumed” set of test(s) will be represented in the dialog box “Gehman 23 °C test result”. Follow the same procedure as previously described in this text.

Go to chapter 3.2.3 Low temperature test, when all 23 °C tests are approved with “Save to file”.

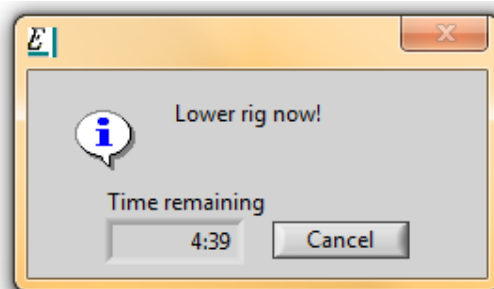


Figure 3.2.2b

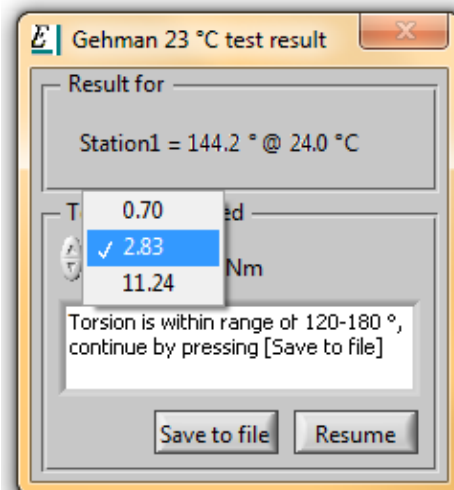


Figure 3.2.2c

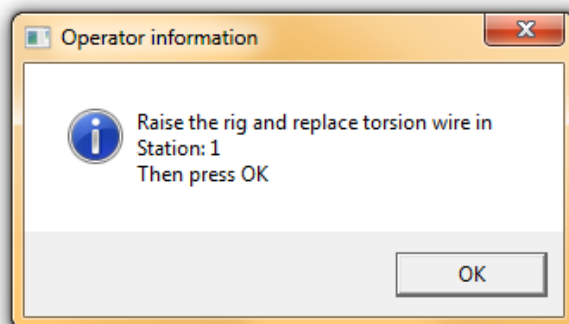


Figure 3.2.2d

### 3.2.3 Low temperature test

If the 23 °C test was performed in LIQUID, raise the rig to the upper position.

A new dialog appears, see figure 3.2.3a. Press OK.

The dialog box “Start procedure (23 °C test)” will change to “Start procedure (Low temperature test)”, if the 23 °C test has been performed correctly.

After 23 °C test in:

#### Air

The start temperature was probably set as described in chapter 3.1.3 Cooling of the liquid. It is however possible to change the temperature in the box “Start temperature”, e.g -73°C.

#### Liquid

Type the start temperature in the box “Start temperature”, e.g -73°C.

Set the “Condition time” (delay before first measurement), set the “Temperature ramp” and “Twist interval”.

The actual temperature will be shown under “waiting for start temp” and the label will change to “Temp. ready lower rig now” when the preset temperature has reached the start temperature. Lower the rig and the countdown for the “Condition time” starts and will be shown under “Condition time left”.

**Note:** It is very important that No other programmes are running on the computer at the same time as the *Freezing* software is collecting data from the Gehman Tester.

The *Freezing* software is working with some time critical operations and needs all system resources, see minimum requirements for *Freezing*.

The test will automatically stop when the first end condition is met. This is done separately for each test station.

When all stations are finished a dialog box appears.

The actual status for all software commands is shown in the lower right hand corner of the software, see figure 3.2.3c.

**Note:** When all stations are finished, the program shows “All measurements are ended”. Press OK and the instrument starts to cool to the pre-set temperature.

To make a new test, raise the rig and remove the specimens. Close all measurements in the software *Freezing* and go to chapter 3.2.1.

When the Gehman Tester is not in use drain all of the liquid and store it in a safe place.

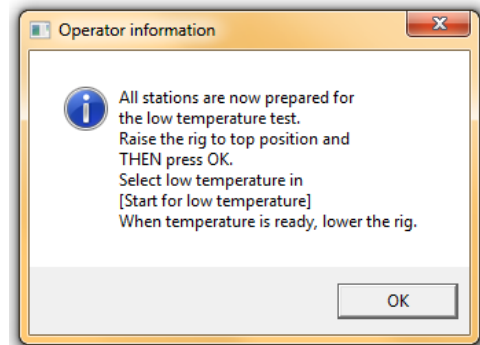


Figure 3.2.3a

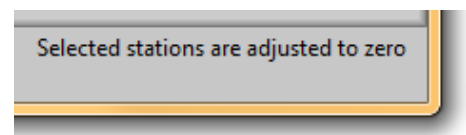


Figure 3.2.3c

## 4. Temperature calibration

The controller and sensor are adjusted at delivery and calibrated according to the attached certificate. Calibration should be done annually.

## 5. Service and maintenance

Empty the container when not using the Gehman Tester.

To clean the container and remove test pieces etc. from the bottom, remove the plate holding the motor and pump. Now you can lift up the grid in the bottom of the container and clean the bottom. This procedure is not recommended to do unless the bottom surface is extremely littered and dirty. The grid itself will catch most broken or lost test pieces.

**Note:** Be careful not to damage the temperature sensor when removing or reattaching the grid.

It is important to always keep the instrument clean to prolong the lifetime of it.

## 6. Troubleshooting

If the instrument does not function as expected, try to match the symptom with any of the descriptions below.

**No communication with the instrument.** If this occurred suddenly, it is most likely a loose or damaged data cable. Check the cable between the instrument and the computer. Also be sure that the instrument is switched on. A blown fuse could have caused a power down on the instrument.

**No power at all.** Switch off the main switch. Remove the power cord from the mains inlet. Pull out the fuse holder and check the two fuses. The value should be 6,3 AT for a 230–240 VAC instrument and 10 AT for a 100–120 VAC instrument. Replacement fuse must be of a ceramic kind. Replace any broken fuses, pull back the fuse holder and attach the main board. Switch the mains back on.

**No power to the panel instruments.** Switch off the main power and remove the power board from the instrument. Remove the hatch from the right hand side of the instrument (two screws). Locate the fuse F3 (2 AF) with help of the schematics (schematics can be found on the USB flash drive for the instrument). Replace the fuse with a new and try again. Always use the same value for a replacement fuse.

**No power to rig sensors.** Switch off the main power and remove the power board from the instrument. Remove the hatch from the right hand side of the instrument (two screws). Locate the fuse F4 (2 AF) with help of the schematics (schematics can be found on the USB flash drive for the instrument). Replace the fuse with a new and try again. Always use the same value for a replacement fuse.

**No power to the pneumatic valves or cryogenic valve.**

Switch of the main power and remove the power cord from the instrument.

Remove the hatch from the right hand side of the instrument (two screws).

Locate the fuse F5 (4 AF) with help of the schematics (schematics can be found on the USB flash drive for the circuit drawings). Replace the fuse with a new and try again. Always use the same value for a replacement fuse.

**6.1 Alarm**

**A few problems will be displayed on the touch screen.**

**A description is shown below.**

Any active alarm will be indicated as a flashing alarm button.

Error code	Problem cause	Remedy
000	No power on fuse F4.	Replace fuse F4.
013	Failure on agitator pump.	Contact support.
014	Temperature Communication Timeout.	Contact support.
015	Backup battery low.	Replace battery in the touch screen (contact support).
028	No power on fuse F5.	Replace fuse F5.
042–045	Internal communication problem.	Contact support.
046	Over temperature in bath	See remedy below.

**Over temperature in bath.** The over temperature protection is activated. If the fluid inside the container is above 30 °C/86 °F, let the fluid go down in temperature. Then locate the “over temp reset”-button on the left side of the instrument. The button is located inside the punched hole of the steel chassie.

Use a small screwdriver an press back the green button. Turn the instrument off from the main switch. Wait for about 5 seconds and turn the instrument back on.

## 7. Safety

**Warning!** Be careful when handling the liquid, the dry ice or liquid nitrogen. Wear protective clothing and safety glasses.

**Warning!** We strongly recommend to arrange a ventilation to take care of the vapours from the liquid.

**Warning!** Keep your fingers away from the rig when you raise or lower the rig, to avoid getting pinched.

**Warning!** See to that used Nitrogen gas is taken care of. There is a hose connection on the backside of the machine marked EXHAUST. We recommend to connect this outlet to ventilation.

**Important!** For the best performance of the instrument, we recommend the following working environment:

- Standard laboratory temperature of either  $23\text{ °C} \pm 2^\circ$  or  $27\text{ °C} \pm 2^\circ$ .
- Humidity not more than 90 % RH – non condensing.
- Other environmental aspects: Pollution degree 2  
– Laboratory environment.

## 8. Technical specification

### Temperature control

Temperature range, °C:	-80 to +30
Accuracy, °C:	$\pm 0,5$
Resolution, °C:	$\pm 0,1$
Sensor:	Pt 100, 1/3 DIN

### Length measurement

Indicators, no:	6 pc digital encoders
Resolution, mm:	0,1
Measuring range, °:	0 to 182 <sup>1)</sup>

### Test rig

Rig material:	Stainless steel and aluminium
Min/max test samples, l × w × t, mm:	$40 \pm 2,5 \times 3 \pm 0,2 \times 2 \pm 0,2$
Test stations:	6

### Other specifications

Dimensions, external, b × h × d, mm:	$680 \times 1010 (1260)^{2)} \times 710$
Weight, kg:	approx 90
Cooling liquid volume, l:	about 8
Voltage, V:	220–240 VAC 50/60Hz (alt. 110–120 VAC)
Power, W:	600
Air supply, Bar:	4–6
Computer connection:	Ethernet

<b>Standards:</b>	ISO 1432, ASTM D 1053
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*1) Testing range adjustable from 0-182°. Adjusted at 0-180°.*

*2) Test rig in raised position.*

## Support

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