Elastocon®

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Manual
Creep and Relaxation Tester, EB 18-II

- **For stress relaxation tests according to ISO 3384 and ISO 6914**
- **For creep tests according to ISO 8013 and ISO 899**

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Contents

Technical documentation supplied on USB flash drive

1. Setting up the Creep and Relaxation Tester

Place the Ageing Oven on a stable and horizontal bench.

Connect the oven to a grounded mains outlet, according to the type label on the oven. We recommend the use of an Earth Leakage Detector.

This instrument is delivered with a UPS unit (uninterruptible power supply). See chapter 3.2.3 for possible UPS settings.

2. Installation

The software is already installed on the computer. This includes:

a) EC 13 Creep/Relaxation – for running the instrument.

b) Mac-talk – for the troubleshooting the servo motors.

Connect the keyboard, computer screen and mouse to the computer and connect the Ethernet cable between the computer and the EB 18-II instrument.

All functions for the instrument is controlled by the software EC 13 Creep and Relaxation, except raising and lowering of the test rigs, which is done by using the PLC screen. **See chapter 3.**

2.1 Important computer settings

The following settings must be set to guarantee a stable function of the Creep/Relaxation application.

When the system is shipped, the computer will already have appropriate settings applied, but if Windows is updated or reinstalled, these settings may be affected. If so, the following settings must be reviewed and applied to ensure a stable function of the Creep/Relaxation application. The name, availability, location of and configuration for these settings may vary with Windows versions.

1. Never turn off hard drives.

2. Never put the computer to sleep.

3. Inactivate hibernation usage.

4. Never allow hybrid sleep.

5. Do not enable wake up on LAN.

6. Do not let Windows automatically restart the PC after updates are installed.

7. Disable automatic update and install for Windows. Download of updates are allowed, but no automatic installations. The reason for this is that the system may re-boot the computer after installing updates while the Creep/Relaxation application is running.

8. Disable Windows Fast Startup. Fast startup may interfere with the recognition of attached hardware.

9. Disable automatic scanning of Creep/Relaxation test files by any anti-virus software. Since these files will often be written to, some anti-virus software may see that as a potential threat and lock the files. There is also a risk that a check of the file interferes with the Creep/Relaxation application, as it may lock the file when it is being saved to, possibly causing an unexpected behaviour of the Creep/Relaxation application and loss of test data. The test files are normally stored at *%userprofile%\documents\Elastocon data*, but this can be changed in the application, in the *Options* window.

10. If using a firewall – permanently allow the IP-address of the Creep/Relaxation instrument to act as client and server.

11. Disable Windows Fast Startup. Fast startup may interfere with the recognition of attached hardware.

12. Disable Windows Fast Startup. Fast startup may interfere with the recognition of attached hardware.

Backup considerations

It is highly recommended that the test files folder be backed up regularly since it contains your valuable data. The test files are normally stored at *%userprofile%\documents\Elastocon data*, which also contains user configuration files, but this can be changed in the application, in the Options window. It is also advisable to regularly back up the application configuration, which includes the calibration data. This folder is located at *%ProgramData%\Elastocon*.

3. The PLC touch screen

Some functions are operated directly on the touch screen such as:

– Operate the rig positions up and down in the cell oven.

– Restore hardware functions after power failure and emergency stop.

– View the many different alarm states.

A stylus pen is included to use on the touch screen.

3.1 Touch screen

Note! Do not use sharp objects to touch the screen. This can cause damage on the screen.

The touch screen will start to initialize the instrument as soon as the power is switched on by the main power switch.

A self-diagnostic will be executed, and all settings, configurations and additional user information will then be loaded from the micro SD card to the touch screen.

Figure 3.1 – Initialization on power up.

3.2 Touch screen – Settings

The main screen will appear after boot
and initialization.

Explanation

1. Date & time.

2. UPS (Uninterruptible Power Supply) Status.
Sine wave symbol = Normal main power.
Battery symbol = Instrument on UPS power.

3. Temperature process value – the actual
temperature in each corresponding cell.

4. Temperature process value – the actual
temperature inside the hood.

5. Alarm Buzzer on or off. See chapter 3.2.6.

6. Control status:
Control On = Normal
Emergency Stop is Active = The Emergency
button is pressed and the additional
"DO NOT reset emergency button until 0"
sign is visible. See chapter 3.2.7.

7. Power Failure – Always flashing on power up
and after power failure. See chapter 3.2.2.

8. Alarm button. See chapter 3.2.6.

9. History button. Tap this button to list a number of previous alarm indications.

10. About button. Tap this button to see company and version -information.

11. Rig button up and down – arrow. See chapter 3.2.4.

12. Rig Door Closed/Open. Indicated if the rig (Hood) door is closed or open.
Rig lift movement will stop and remain immobilized when the rig door is opened/open.
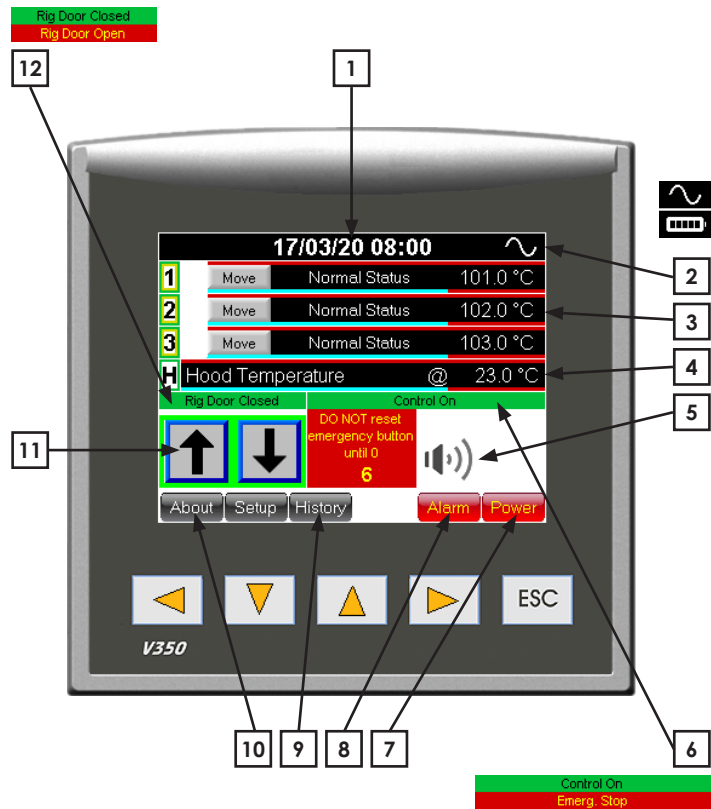
3.2.1 Temperature setting

All temperature settings are normally initialized/operated from the software EC 13, but it is possible to set the oven cell temperatures directly on the touch screen. All these temperature settings will be overridden by the EC 13 software if the temperature is set in the software.

Tap directly on the relevant channel process value to enter the test temperature screen.
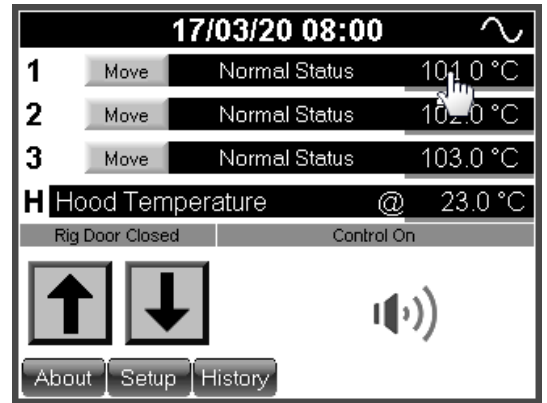**(Figure 3.2.1.a)**

Figure 3.2.1.a – Temperature setting

A correlated set temperature box will show. Tap on the set temperature button to enter a new value.
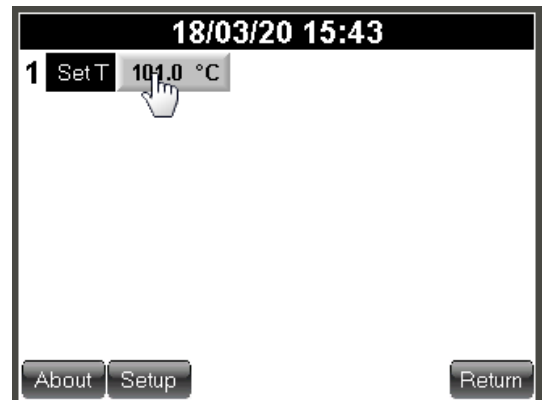**(Figure 3.2.1.b)**

Figure 3.2.1.b – Temperature setting

A numeric keyboard will show. Type in the set temperature with the numeric keyboard and finish with a tap on the return button.
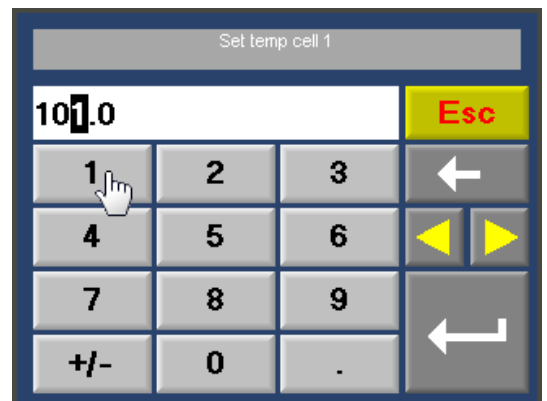**(Figure 3.2.1.c)**

Figure 3.2.1.c – Temperature setting

3.2.2 Power failure

Power failure
The EB 18-II instrument will always indicate power failure when the instrument is powered up.

Power failure indicator (Figure 3.2.2.a)
When the power is resumed after a power-up/failure a button will be lit up on the screen.

Tap on the *Power Failure* button to see more information and to reset the power failure.

A new screen will show **(Figure 3.2.2.b)**.
This feature will give the operator information about duration of the power failure and temperature drop caused by the power failure. The power failure button will remain until the button *Clear & Exit* is tapped.

3.2.3 Set up screen (user)

Password (Figure 3.2.3.a)
A password is needed to enter the set up mode.

Tap on the *Setup* button on the main screen to enter the password screen for set up.

Default password is: 1111

Temperature offset (Figure 3.2.3.b)
In the set up mode the offset is adjusted according to calibration. When a re-calibration is done, values may have to be adjusted again.

An individual offset value can be added to both the temperature-indicator and -controller.
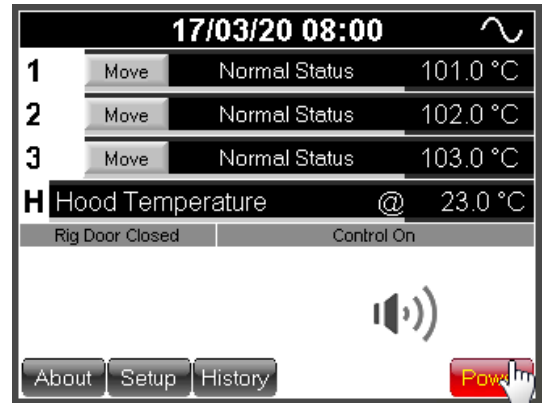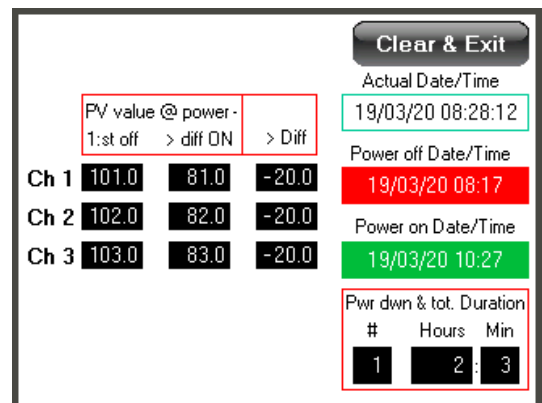

Figure 3.2.2.a – Power failure
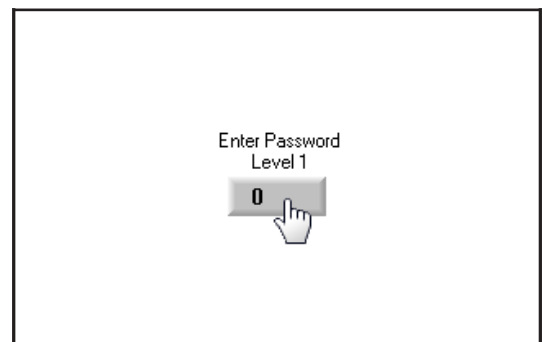

Figure 3.2.2.b – Power failure

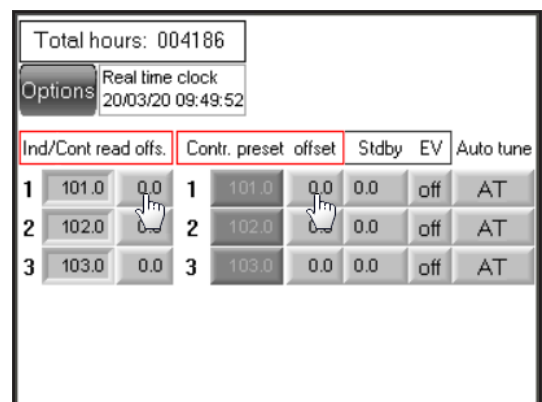**Figure 3.2.3.a** – Password

Figure 3.2.3.b – Temperature offset

Standby temperature (Figure 3.2.3.c)

For the EB 18-II instrument, this standby temperature will be overridden by the EC 13 Creep/Relaxation software, when the temperature is activated for the specific test. The standby temperature is mainly used when the instrument is not being used and with a tap on one button the temperature will be set for all oven cells that has a set standby temperature.

It is possible to preset an individual standby temperature for each oven cell.

To set-up the standby temperature setting, tap on the corresponding oven cell control (below *Stdby*).

A zero value in this control will inactivate the function and no temperature will be set when standby is initiated. A zero value in the control will remain at the current set value.

A higher value than zero represents the temperature set value. Eg. if the operator sets the standby control to 30, the oven will go to 30 °C as the standby temperature button is being pressed.

The oven has no cooling. The temperature will just cool off naturally. The cooling time depends on the room ambient temperature. The standby set temperature will not be limited by the minimum possible set value. Therefor the set value initiated by the standby control can be lower than the normally minimum limitation.

Real time clock (Figure 3.2.3.d)

Tap on the real time clock control to set time and date.

This is the system time and date and this time/date stamp will be included to all alarm and time critical information visible on the screen.

Use the numeric keyboard to set a new time and date.

UPS settings

While the setup view is displayed, press the button *Options*.

A UPS symbol is visible on the right side of some of the display controls such as *Air/pump, Controllers 1-3 (Cell Temperature controllers) & H ON/H off (Hood temperature controller)*.

Symbols activated (UPS Power save on) next to any display control will cut out this display control at power failure (instrument on UPS battery power). For example, if the symbol is active next to Controller 1, the power will be cut out for controller 1 (oven cell 1).

The more active UPS Power set to ON , the less power will be drawn from the UPS battery at power down and the instrument can be battery powered for a longer period of time.

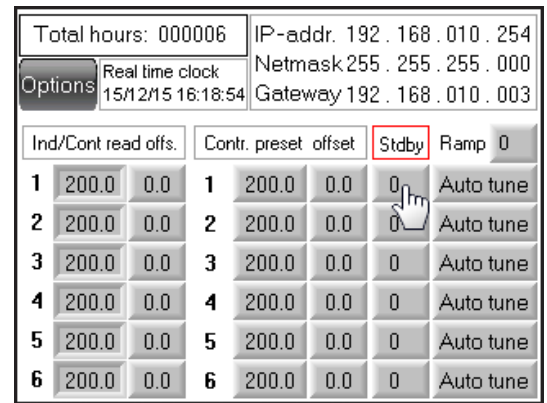A default setting for the UPS function is Controllers 1 to 3 = ON and H ON/H off = ON.
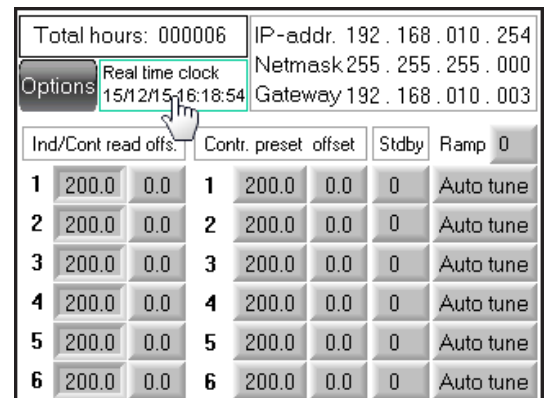

Figure 3.2.3.c – Standby temperature

Figure 3.2.3.d – Real time clock

3.2.4 Rig button up and down (Figure 3.2.4.a+b)

On power up or when the power is resumed after a power failure, any of the three rigs can only be raised (arrow down not visible).

Each station will also show the status "Only UP allowed".

When instrument has been power up, tap on any of the three Move buttons that corresponds to a rig that needs to be elevated and then tap the arrow up button to raise this rig.

Do the same for the other two rigs.

Note! If a test is running, do not raise any of the rigs at this moment. Wait until the tests are finished before any of the rigs can be elevated.

The rig must fulfill the movement to the top position. If the movement is interrupted, try and find out why it stopped, check the door status (closed) and press the arrow up button again.

After this procedure, the arrow down button will be visible and the rigs can be lowered/ raised when any of the corresponding Move buttons are pressed.

After 1 min of screen inactivity, the button Selected will switch back to Move.

Rig movement is not possible with an open door. Door status is indicated as Rig door open on the main screen.

Warning! Although movement of the rig cannot be performed with the door opened, movement of the upper plate/grip is possible from the Creep Relaxation application when the door is opened, therefore it is vital to keep fingers away from the rig when performing movement operations using the application.

If the rig gets jammed while in motion, this sensor will activate a safety stop. This stop will be indicated in each corresponding rig status on the touch screen.
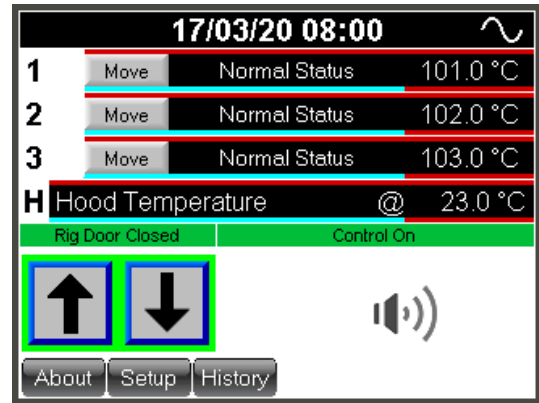**(Figure 3.2.4.c)**

Figure 3.2.4.a

Figure 3.2.4.b

Figure 3.2.4.c

3.2.5 Acknowledge any alarm

To acknowledge any alarm, tap on the button *Alarm*.

Figure 3.2.5.a. All active alarms can be seen on this screen. Press the magnifying glass to the right side of the alarm ID 00 in the alarm group list to view all active alarms in that group.

This oven will present all active alarms in the group named ID 00.

All the alarms in this group are divided into two levels depending on how serious the alarm is.

First level will reset the alarm automatically, but still requires an acknowledgement to be cleared from the alarm list.

Second level must always be acknowledged by the operator manually.

Figure 3.2.5.b. To acknowledge an alarm, press the magnifying glass to the right of the chosen alarm.

Figure 3.2.5.c. Press the button *Ack* and the alarm will be reset.

Any alarm that is reset automatically will remain in the alarm list until a normal condition is met. The red *Alarm* button will however switch from flashing to a fixed state.

Alarm that still persists will show up again after the acknowledge procedure.

Press the *Esc* button several times to return to main screen.

History

The *History* button will show a record of all previous alarm.

Figure 3.2.5.a

Figure 3.2.5.b

Figure 3.2.5.c

3.2.6 Alarm

Alarm is activated at:

• high temperature in the test chamber, +1 °C from set value

• low temperature in the test chamber, -1 °C from set value

• high temperature of the controller, +5 °C from set value [1]

[1] This alarm will be reset automatically when the temperature is within tolerance from set value again.

Error code	Problem cause	Remedy
001–006 Cell 1–6	Oven cell is too warm.	The alarm will be reset when the alarm has been acknowledged and the cell has cooled down.
007–012 Cell 1–6	Temperature difference between set value and process value ±1 °C.	Wait until the temperature is within range to acknowledge the alarm.
013	Low pressure from airpump.	Check the airpump filter and function.
014	Shinko Communication Timeout.	Contact support.
015	Low battery.	Replace backup battery in OPLC (contact support).
016–021 Cell 1–6	Loop break controller #.	Broken temperatur sensor, call for service.
022–027 Cell 1–6	Temperature difference between set value of controller and actual value +5 °C.	Acknowledge the alarm. When temperature is within range the alarm will be reset. If the alarm is not reset contact support.

Coloured lines on PV and SV display indicates alarm status.

• A red line above PV display = PV temperature differs +1 °C from SV temperature.

• A light blue line below PV = PV temperatures differs -1 °C from SV temperature.

• A red line above SV = SV differs +5 °C from actual controller temperature.

• A green line below SV = PV temperature is within ±1 °C from SV temperature.

SV temp. diff. alarm to general alarm collection list and flashing alarm button will only be active for running channels (active count down meter).

Alarm will activate a buzzer and/or a flashing red Alarm button. The buzzer can be switched on and off by a tap on the buzzer symbol.

If the alarm button starts to flash, go through the check list in chapter *2.2.6 Alarm* to identify the alarm and address the problem for proper action.

Buzzer on   **Buzzer off**

3.2.7 Control status

The normal status will indicate Control ON in the main touch screen.

The main touch screen will show Emergency Stop is Active, when the emergency stop is activated.

As the emergency button is pressed, the screen will start to count down a time from emergency button activation.

This time must reach 0 before the emergency button can be released from the active state.

If the emergency button is released before this time has reached 0, the function will not restore motor drivers correct.

When the emergency button is released, all stations must be elevated to find the index top position again. See chapter 3.2.4 Rig button up and down.

If a test is running, **DO NOT** perform this until the test has ended. This is also described in chapter 3.2.4.

4. Instrument start-up

This chapter describes how to power up the instrument correctly.

Instructions

1. Make sure that the emergency stop is released. If the emergency button is pressed, turn the red knob anticlockwise to release it.

2. Switch the power on with the red power switch on the instrument panel.

3. Follow chapter 3.2.4 to Raise all the test rigs to top positions.

   Note! All rigs must be indexed to the top position at start up. The rigs cannot be lowered into the ovens if this step is left out. However, if the rig is in the bottom position and tests are running, the index to top position can wait until it is necessary to raise the rig.

4. Make sure that the cells are clean inside, especially in the bottom.

   Note! The thermal contact will not be ideal, and the oven will not transfer proper heating to the rigs, if there is dirt on the bottom.

5. Turn on the computer. When Windows has started, the default user will automatically be logged in and the Creep Relaxation application will then start automatically.

5. Mechanical – Rig setup

This chapter describes how the rig can be configured for different set-ups. Each different chapter describes all steps on how to convert the rig.

Follow the instructions and do not dismount the entire rig.

After the conversion is complete, the corresponding load cell configuration file must be loaded. Follow the instructions in chapter 7.12.

Note! If the load cell configuration is not updated to match the mounted load cell, mechanical failure could occur, and all measurement data will be invalid.

Possible set-ups:

a) Compression – Chapter 5.1

b) Tension – Chapter 5.2

c) Compression high temperature

d) Tension high temperature

e) Compression liquid

f) Compression HT liquid

g) Compression pressurized liquid

h) EB 02.26 add on

Warning: To prevent burn injury, it is recommended to perform the re-configuration before heating up the rig. If the rig is warm – raise the rig to the top position and let it cool off (See chapter 4 figure 9). Set the oven temperature to a low temperature and wait for it to cool off. Temperatures from and above +50 °C may cause burn injury.

5.1 Mechanical conversion from Compression

The rig must be configured for compression before this chapter can be followed.

a) Perform a "Find zero" for Compression set-up (see chapter 6.1.2).

b) If the rig is in the top position, lower the rig to the bottom position.

Let the compression plates be positioned close to each other for a more convenient dismount. Use manual movement as described in 6.8 to move the plates close together.

c) Open the door.

d) Read through and follow instructions in drawing S10167-C.

e) Make sure that all components have the correct heights according to separate drawing S10167-C. The drawing can be found on the instrument USB flash drive.

5.2 Mechanical conversion from Tension

The rig must be configured for tension before this chapter can be followed.

a) Perform a "Find zero" for Tension set-up (see chapter 6.2.2).

b) If the rig is in the top position, lower the rig to the bottom position.

c) See chapter 6.8 to move the position for the upper clamp/tension rod, so there is about 5–10 mm between the teeth belt wheel on the top of the ball bearing screw and the lower edge of the key grip on the ball bearing screw.

d) Read through and follow instructions in drawing S10167-C.

e) Make sure that all components have the correct heights according to separate drawing S10167-C. The drawing can be found on the instrument USB flash drive.

6. Software – Test setup

Note! Before continuing with this chapter, make sure to:

1. Start up the instrument according to chapter 4.
2. Configure each rig for compression or tension according to chapter 5.1 or 5.2 respectively.

Note! Running the rig from the software with an incorrect configuration may damage the rig permanently.

Introduction

The application *EC13 Creep Relaxation* supports two different methods: *Relaxation* (chapter 6.1) and *Creep* (chapter 6.3). These two different methods can run in either *Compression* or *Tension* test type.

A mix of different test types can run in parallel. Each rig will work and log individually. However, the methods cannot be mixed. Either of the methods *Relaxation* or *Creep* is selected for all rigs.

Launch *Creep Relaxation*. The method selector will appear.
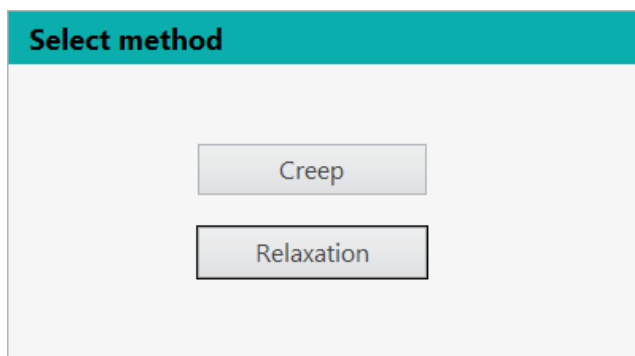
Click on the desired method. The application will initiate the instrument with the selected method.

The main window will have all available rigs listed on the left side with one *Setup* button for each rig/station (the cog-wheel: ⚙), with the rig number to the left of the cog-wheel.

Click on the set-up button (the cog-wheel: ⚙) for any of the stations to open the setup window for that station.

The application main window has two views: *Logger* and *File Viewer*.

The Logger view is what you will use when running tests. The Viewer is used for viewing measurement log files. Each of these views has its own graph, so you can view log files while at the same time running a test. To switch between the Logger view and Viewer, click the *Logger* or *Viewer* button.

To set-up a test, continue with the chapter for the selected method:

6.1–6.1.1 / 6.2.1 (Relaxation – Compression / Tension)

or **6.3–6.3.1 / 6.4.1 (Creep – Compression / Tension)**, depending on which method was selected.

6.1 Relaxation method

This chapter describes how to run the instrument using the Relaxation method.

Before starting a new test, it is necessary to initialize a reference zero for all test station that will be used. Both position and force will be zeroed.

Note! Make sure that no sample is mounted in the rig before zeroing.

For relaxation in compression mode, continue to chapter 6.1.1.

For relaxation in tension mode, continue to chapter 6.2.1.

6.1.1 Relaxation in Compression mode

Follow the instructions in the following chapters to run the instrument in Relaxation Compression mode.

6.1.2 Zero force and position in Relaxation Compression mode

Instructions (The steps correspond to the numbered arrows in Figure 6.1.2)

1. Click *Setup* ⚙ for a station.
2. Select test type from the *Test type* drop-down selector.
3. Click *Test piece and movement*.
4. Click *Find zero*.

The upper plate will now move downwards until the plates touch. The upper plate then moves back and closes again at a lower speed.

Complete the same procedure for all test stations mechanically configured for compression mode.

All stations in compression mode are now ready to be used. Continue with the following sub chapters.

Tip: Manual movement can be used to decrease the distance towards the zero-position before zeroing, to speed up the zeroing process, see 6.8.

6.1.3 Set the test temperature

To set-up the test temperature for each station, continue to chapter 6.5.1.

6.1.4 Test identification

To set-up the test identification for each station, continue to chapter 6.5.2.

6.1.5 Data recording

To set-up the data recording intervals for each station, continue to chapter 6.5.5.

6.1.6 Speed

To set-up the speed settings for each station, continue to chapter 6.5.6.

6.1.7 Setup Test Piece Dimensions

To set-up the speed settings for each station, continue to chapter 6.5.3.

6.1.8 Sample mounting prep + pre-heat rig without sample

To set-up mounting and preparations, continue to chapter 6.6.

6.1.9 Start/stop

To start the test, continue to chapter 6.5.8.
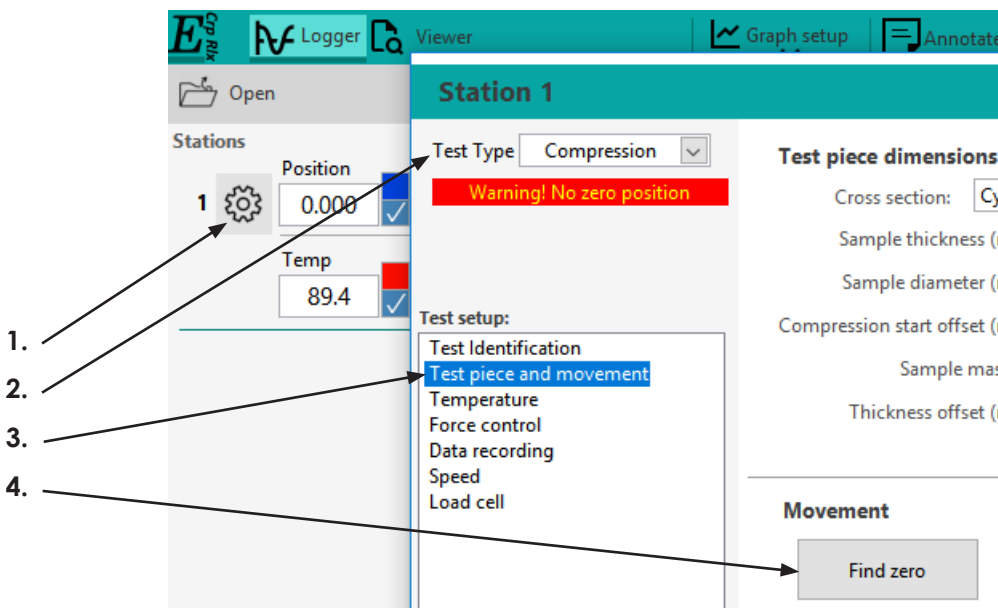
Figure 6.1.2 – Zero force and position in Relaxation Compression mode.

6.2.1 Relaxation in Tension mode

Follow this chapter to run the instrument in Relaxation Tension mode.

6.2.2 Zero force and position in Relaxation Tension mode

Instructions (The steps correspond to the numbered arrows in Figure 6.1.2)

1. Click *Setup* ⚙ for a station.
2. Select *Tension* from the *Test type* drop-down selector.
3. Type in 50 mm in the field *Test Length* or any other relevant test piece length.
4. Have a gauge block of the same length as typed in the *Test length* field ready.
5. Click *Find zero*. The application will let you know when to put in the gauge block.

The software will give detailed instructions during the zero process.

Complete the same procedure for all test stations mechanically configured for tension mode.

All stations in tension mode are then ready to be used. Continue with the following sub-chapters.

6.2.3 Set the test temperature

To set-up the test temperature for each station, continue to chapter 6.5.1.

6.2.4 Test identification

To set-up the test identification for each station, continue to chapter 6.5.2.

6.2.5 Data recording

To set-up the data recording intervals for each station, continue to chapter 6.5.5.

6.2.6 Speed

To set-up the speed settings for each station, continue to chapter 6.5.6.

6.2.7 Setup Test Piece Dimensions

To set-up the speed settings for each station, continue to chapter 6.5.3.

6.2.8 Sample mounting prep + pre-heat rig without sample

To set-up mounting and preparations, continue to chapter 6.6.

6.2.9 Start/stop

To start the test, continue to chapter 6.5.8.

6.3 Creep method

This chapter describes how to run the instrument using the Creep method.

Before starting a new test, it is necessary to initialize a reference zero for the test stations. Both position and force will be affected.

Note! Make sure that no sample is mounted in the rig before zeroing.

For creep in compression mode, continue to chapter 6.3.1.

For creep in tension mode, continue to chapter 6.4.1.

6.3.1 Creep in Compression mode

Follow the instructions in the following chapters to run the instrument in Creep Compression mode.

6.3.2 Zero force and position in Creep Compression mode

Instructions

Follow the same procedure as in 6.1.2.

6.3.3 Set the test temperature

To set-up the test temperature for each station, continue to chapter 6.5.1.

6.3.4 Test identification

To set-up the test identification for each station, continue to chapter 6.5.2.

6.3.5 Physicals

To set-up the force load parameters, continue to chapter 6.5.4.

6.3.6 Data recording

To set-up the data recording intervals for each station, continue to chapter 6.5.5.

6.3.7 Speed

To set-up the speed settings for each station, continue to chapter 6.5.6.

6.3.8 Setup Test Piece Dimensions

To set-up the speed settings for each station, continue to chapter 6.5.3.

6.3.9 Sample -mounting and -preparations

To set-up mounting and preparations, continue to chapter 6.6.

6.3.10 Start/stop

To start the test, continue to chapter 6.5.8.

6.4.1 Creep in Tension mode

Follow this chapter to run the instrument in Relaxation Tension mode.

6.4.2 Zero force and position in Creep Tension mode

Instructions

Follow the same procedure as in 6.2.2.

6.4.3 Set the test temperature

To set-up the test temperature for each station, continue to chapter 6.5.1.

6.4.4 Test identification

To set-up the test identification for each station, continue to chapter 6.5.2.

6.4.5 Physicals

To set-up the force load parameters, continue to chapter 6.5.4.

6.4.6 Data recording

To set-up the data recording intervals for each station, continue to chapter 6.5.5.

6.4.7 Speed

To set-up the speed settings for each station, continue to chapter 6.5.6.

6.4.8 Setup Test Piece Dimensions

To set-up the speed settings for each station, continue to chapter 6.5.3.

6.4.9 Sample -mounting and -preparations

To set-up mounting and preparations, continue to chapter 6.6.

6.4.10 Start/stop

To start the test, continue to chapter 6.5.8.

6.5.1 Set-up the test temperature

The test temperature is normally set from the software. The temperature can be set directly on the instrument under special circumstances, but it is not described in this manual.

The temperature is individually configured for each station.

The temperature set-up supports:

a) A fix test temperature.

b) Wait for temperature to reach set point with a specified settle time.

c) A two-point temperature ramp.

d) Deactivating temperature controller when logging is stopped.

Set the temperature

Instructions

1. If not already in the setup window for the station, click *Setup* for the test station and click on *Temperature* in the *Test setup* list.

The following chapters describes features that can be found on the temperature control screen.

Wait for Temp

Tick *Wait for temp* to enable waiting for temperature before applying compression/tension. With this feature enabled, the log will start recording as usual when *Start* is clicked if the temperature controller is enabled, but no compression or tension will be applied until the specified temperature condition is met. Note that the temperature controller must be activated to control the temperature and wait for the temperature. To enable the temperature controller, click *Enable & Set* (explained below). By default, the temperature controller is deactivated once a test is stopped, so it will need to be activated if you start a new test.

Settle Time

Specifies the delay to add once the temperature is reached (within a specified Tolerance). It is advisable to add a suitable settle time to let the test piece settle in temperature. The set time is displayed in the main window and the remaining time is displayed in the main application window. The compression or tension will be applied when the settle time has elapsed.

Settle time will allow the test material to reach a uniform temperature. There is no typical setting for this parameter but may be described in any relevant test standard.

Tolerance

The temperature difference from initial temperature to allow when Settle Time starts.

A typical setting of Tolerance is 2.0 °C. A small tolerance value will slow down the start significantly since the last 1 or 2 °C of temperature increase may take long time to reach and may never be reached if there is an offset between the temperature controller's temperature and the temperature probe's temperature that is higher than the Tolerance value.

Although the temperature controller will control the temperature very accurately, the temperature probe can measure a different temperature, and the offset between the controller temperature and measured temperature can differ depending on measurement type (Compression/Tension) and test piece characteristics. Tolerance can be set to an appropriate value where the temperature is near its stabilization point but still is offset to the set controller temperature.

Testing in liquid

If testing in liquid, we recommend that you preheat the liquid to your test temperature (can be done in any laboratory oven for convenience). If the liquid is preheated the waiting time to reach and stabilize the temperature will decrease significantly.

Ramp temperature

Tick this box to enable the temperature ramping.

Ramp temperature will create a linear temperature ramp from test start. The temperature ramp will start when the initial temperature has been reached within the set tolerance and the settle time has passed. The ramp will set set-temperatures as specified by the ramp parameters. The actual temperature change rate may differ from the specified set-temperature ramping, depending on what the temperature was before starting the ramp, how fast or slow the system reacts to temperature change, and what temperature controller is used.

Note! Creating a decreasing ramp will not work properly, unless the oven has a cooling option. An increasing ramp may not work properly when exceeding 2 °C/min.

When the ramp has reached the final temperature, the final temperature will remain for the rest of the logging.

Ramp time

Specifies total ramp time in minutes. The ramp's first and last temperature is specified in the initial/final target temperature settings.

Target temperature

Initial

Sets the target temperature. If ramp is selected, this is the ramp's starting temperature.

Final

Set the final temperature for the ramp. When the ramp is finished, the oven will stay on this temperature.

Advanced

Start temp control on "Enable & Set"

If enabled, starts temperature controller and sets the initial temperature when clicking "Enable & Set", instead of waiting until "Start" is clicked. This also means that any set waiting criteria will be initiated. So, when the temperature is reached, settle time will start running even if the test has not been started. The actual test initialization (compression or tension) will still not start until Start is clicked.

Enable & Set

Enables the temperature controller and applies temperature controller settings.

Disable

Disables the temperature controller.

If disabled, the temperature will not be displayed or logged.

6.5.2 Test Setup – Identification

The Test Setup Identification allows the operator to add and modify the test piece identification.

Instructions

1. If not already in the setup window for the station, click *Setup* on the relevant test station and click on *Test Identification*.

Test setup:

Test Identification

2. Fill in the parameters for:
a) Operator
b) Grade name
c) Comment

The input File name pattern will auto generate a file name based upon the number of wildcard characters followed by an alphabetical character.

Example:

%N-%O-%-%G-%Y-%m-%d

Explanation: *Station number-Operator-Grade name-Year-month-day*

The default setting will create a unique file name based on station number and identification input (station number, operator, grade name and date).

Possible wildcard characters are:

% N = Station number for the current station selected

% O = Operator field

% T = Type of measurement (method – Relaxation or Creep)

%TT = Type of test (Compression or Tension)

% G = Grade name

% Y = Year (from system calendar)

% m = month (from system calendar)

% d = day (from system calendar)

% H = Hour (from 24h system clock)

% I = Hour (from 12h system clock)

% p = a.m. / p.m. -flag

% M = Minutes (from system clock)

% S = Seconds (from system clock)

% a = abbreviated week day name (from system calendar)

% b = abbreviated month day name (from system calendar)

Note:

a) Wildcard characters are case sensitive.

b) There is no need to fill in a file name. The software will add a consecutive number to the file name if the file name already exists (1, 2 ,3 etc.).

6.5.3 Set-up the Test Piece Dimensions

The Test piece dimension and movement setup page enables the user to set up dimension parameters for the test piece and to control the plate movement.

The setup page is used for:

a) Entering test piece dimensions and other features that may affect the measurement.

b) Zeroing.

c) Measuring thickness.

d) Moving to thickness.

e) Moving to gap (thickness plus offset for easy access to insert the test piece).

f) Manual movement of plate/grip.

Note! Make sure that chapter 6.1.2 or 6.2.2 is completed before this chapter.

1. If not already in the setup window for the station, click *Setup* on the relevant test station and click on *Test Identification*.

Test setup:

Test Identification

Test piece and movement
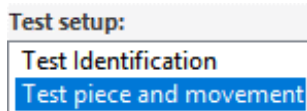
2. Continue with the steps below
– Choose between *Compression* or *Tension*.

Compression

Instructions

1. Raise the rig to the top position (see chapter 3.2.4).

2. Measure the test piece thickness according to the table below. Measure manually with a thickness gauge or use the test rig to measure thickness.

Manually	Using rig (No heating
Use a thickness gauge and measure the test piece height.	Use a caliper or thickness gauge and measure the approximate test piece height.
Type in the measured value in *Sample thickness*.	Type in the measured value in *Sample thickness*.
Enter a gap in the *Gap* input click *Move to Gap*.	Click *Move to Gap*.
Be careful if the rig and oven is warmer than 50 °C.	Lubricate the upper and lower test piece surface.
	Put the test piece centered on the bottom compression plate.
	Click *Measure thickness*. Optionally adjust the parameters for the thickness measurement: Thickness force threshold – Default is 3 N Thickn.meas. speed – Default is 1 mm/min Thickn. meas. Start offset – Default is 0.2 mm. These parameters are optimal for most rubber materials.

If the sample is mounted in a test fixture, *Measure thickness* can be used to measure the height of the test fixture. Tick *Using test fixture* and specify an approximate *Test fixture height*, then click *Measure thickness*. The *Test fixture height* will now be measured and updated instead of the *Sample thickness.*

Warning! There is no built-in safety when using the following movement feature made by the application: *Move to Gap, Move to Thickness, Move to Mount, Move to Test length, Measure Thickness,* and *Manual movement*. Therefore, always be careful when using these features and start with slow speeds and short distances. Although a window with an abort-button will be displayed when these movements are made, there is still a risk that the upper plate/grip will move until it hits the bottom plate/grip or a test piece or gauge block and damage the load cell and in worst case even the motor.

Continue with either:

a) Compression – Relaxation
b) Compression – Creep

Compression – Relaxation

1. Type in the *Sample diameter* (if applicable).

2. Type in the *Compression (%)* or as mm in *Compression (mm)*. The two controls are linked so that entering data in one of the inputs will update the other.

3. If using a test piece fixture, tick *Using test fixture* and specify a *Test fixture height*. Type in the total height for the fixture, including sample.

Compression – Creep

1. Select the *Cross-section* type and type in the *Sample diameter* or *Sample width*.

2. If using a test piece fixture, tick *Using test fixture* and specify a *Test fixture height*. Type in the total height for the fixture, including sample.

Tension

Applies to all methods.

Instructions

1. Specify the *Test length*.

2. Specify a *Mounting length offset*. This is an offset added to *Test length* when mounting the test piece. This is normally a negative value to get a shorter distance between the grips when mounting. A value of -1 is normally suitable for a 50 mm test piece. The 1 mm shorter distance will make it easier to mount the test piece without creating a slack.

3. Click *Move to mounting length*.

4. Mount the test piece.

5. Click *Move to Test length*.

6.5.4 Force control

The *Test Setup Identification* allows the operator to add and modify the test piece identification.

Instructions

1. If not already in the setup window for the station, click *Setup* on the relevant test station and click *Force control*.

    Test setup:
    Test Identification
    Test piece and movement
    Temperature
    Force control
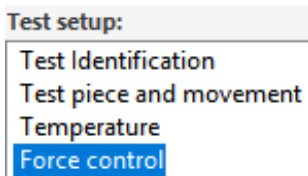
2. To set-up the test piece load, type in a force in Newton or stress in MPa.

3. The two controls for *Force* and *Stress* are linked so that when entering a value in one field, the other will be updated.

4. To set-up a ramp, tick *Ramp force*. Then fill in *Initial* and *Final* force and *Ramp time*.

☐ Ramp force

Ramp time (min) 10

	Force (N)		Stress (MPa)
Initial	100.0	<->	0.8
Final	0.0		0.0

6.5.5 Data recording

The Data recording setup page enables the user to change the sample intervals.

Sample interval is the base sample interval, which defines the fastest possible sample rate for the test. Typical setting is 30 seconds.

Sample interval (s) 30

Logging intervals define the intervals at which data is logged. To reduce memory consumption and file size, data can be logged less frequently during periods with little activity. The right column shows the decimation of data, and the left column the time during which this decimation should be used.

Note: Settings for the data recording is normally set one time and then used as default for all test to come. Any change will remain even after application restart.

Instructions

1. If not already in the setup window for the station, click *Setup* on the relevant test station and click *Data recording*.

2. Type in a time in *Sample intervals* or let the default 30 seconds stay.

3. Click *Modify table* to modify the table.
    a) **To add a new row** – type in the Minutes- and log every n:th sample values on an empty row.

    b) **To delete a row** – rows with data before the "Inf"-row will not be deleted but set to 1, if just erased. To remove any row, move Inf row to an earlier row position and retype the values on all rows before Inf. Values added after the Inf row will not be accepted.

    c) Remember that the last row MUST have Inf typed in the Minutes column and have a value in the Log every n:th sample column.

Example:

Logging intervals

Minutes	Log every n:th sample	
10	1	
60	5	
Inf	10	

Modify table

The above example means that:

– Every data point taken is logged to file and graph for the first ten minutes.

– Then, up to 60 minutes, every fifth point is used (i.e. 5*30 = 150 s if sample interval is 30 s).

– For the rest of the measurement after 60 minutes, every tenth sample (every 300 s) is logged to file and shown in the graph.

Hint: The log intervals will remain on the first log interval if "Wait for temp" (Chapter 6.5.1) is active. The log interval will start to run according to the log table when the temperature is reached, and the compression/tension starts.
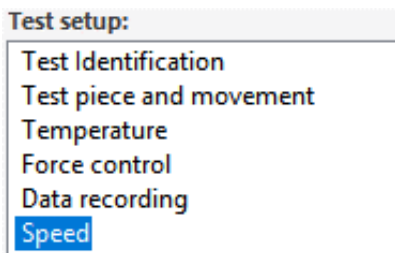
6.5.6 Speed

The Speed setup page enables the user to change and view speed settings for the test rig. The Speed set-up supports:

a) Compression or tension speed for the compression or tension duration (only for relaxation).

b) Free movement speed used during movement of the test rig during setup, e.g. when moving manually and moving to a specific position.

Note! Settings for the speed is normally set one time and then used as default for all test to come. Any change will remain even after application restart.

Instructions

1. If not already in the setup window for the station, click *Setup* on the relevant test station and click *Speed*.

Test setup:
Test Identification
Test piece and movement
Temperature
Force control
Data recording
Speed

2. Type in a suitable speed for free movement speed. Compression/Tension speed can only be viewed from here and can only be set manually from the settings-file. Ask Elastocon for assistance if this is required.

   Typical settings are:

   a) Compression speed = 10 mm/min.

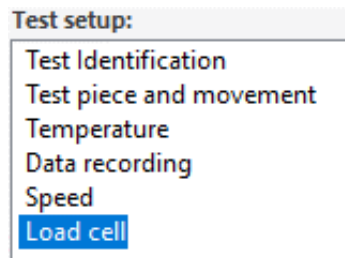   b) Tension speed = 50 mm/min.

   c) Free movement speed = 200 mm/min.

6.5.7 Load Cell

The Load cell page displays the currently loaded *Load Cell ID* and enables changing the configuration to match the mounted load cell.

Note! Settings for the speed is normally set one time and then used as default for all test to come. Changes will be stored in the settings file.

Instructions

1. If not already in the setup window for the station, click *Setup* on the relevant test station and click *Load Cell*.

Test setup:
Test Identification
Test piece and movement
Temperature
Data recording
Speed
Load cell

Check that the *Load cell ID* matches the load cell mounted in the station. If not, change the load cell according to chapter 6.9.

Note! If the load cell configuration does not match the mounted load cell, mechanical failure could occur, and all measurement data will be invalid.

The load cell can be zeroed by clicking "Zero load cell".

6.5.8 Start/Stop

Note! All software and mechanical preparations must be performed before following this chapter.

To start a measurement, click *Start*. The instrument will start recording data.

Load/position will be applied. If the *Wait for temp* is active on this station, mechanical action will hold until temperature is reached and settle time has passed.

When *Start* is clicked, the station window will close.

Click *Cancel* to close the setup window without updating settings, or close the window using the X in the upper right corner of the window. Note that temperature settings are not cancelled by clicking Cancel.

To stop an ongoing measurement, click *Stop*.

6.6 Sample mounting and preparations

This chapter describes how to mount and prepare the sample in the rig.

Temperature conditioning of the rig – all methods and test types

The rig is made from stainless steel and at room temperature it will affect the oven heating. To avoid this, the rig must be preheated. However, the rig can be used to measure the test piece thickness. When using it to measure the thickness, let the rig stay in the upper position in room temperature. If the thickness is already measured, lower the rig now.

Mounting

Compression

Instructions

1. If the test piece thickness was measured with the rig, the test piece should be in a correct position and the sample sides already lubricated.

   Then continue to step 4.

   If the test piece was just measured manually, continue from step 2.

2. Lubricate the test piece upper and lower surface.

3. Put the test piece centered on the lower compression plate.

4. Click Setup on the relevant test station and choose "Test piece dimension".

5. Click Move to thickness to get the preload applied during temperature condition.*

6. Lower the rig into the oven, see chapter 4. fig. 9.

   *a small preload will keep the test piece in place and improves the preheating of test piece and rig.

Tension

Instructions

1. Enter the *Test length*. Enter a *Mounting length offset*, normally -1 is suitable for a 50 mm test piece, but this can vary depending on the material.

2. Click *Move to mount*. The upper grip will then move to *Test length – Mounting length offset* (e.g. if Test length is 50 and Mounting length offset is -1, the upper grip will move to 49 mm).

By positioning the clamp distance 1 mm shorter the actual test length, it will be a lot easier to mount the sample.

After mounting the sample, click *Move to test length*. The upper grip will then move to the test length.

If the measured force at this point is higher than a few Newtons, experiments on different clamping distances must be carried out so that the applied force is not too high.

Note! When running in tension mode, the set temperature may need to be increased to get the correct process temperature, since the temperature sensor is not in contact with the mounting grips and therefore the reported temperature may differ from the test piece temperature.

6.7 Move to Gap

Note! Make sure that chapter 6.1.2 or 6.2.2 is completed before continuing on this chapter. Reckless positioning may cause damage to the compression plates and smaller load cells.

This chapter describes how the user can change the distance between the compression plates or tension clamps using the thickness and an offset (gap).

Instructions

a) If not already in the setup window for the station, click *Setup* on the relevant test station and click *Test piece and movement*.

b) Select test type to *Compression*.

c) Type in a value in *Gap*.

Note! Be careful and do not type in a larger value than relevant. Instead, try smaller steps and repeat the movement.
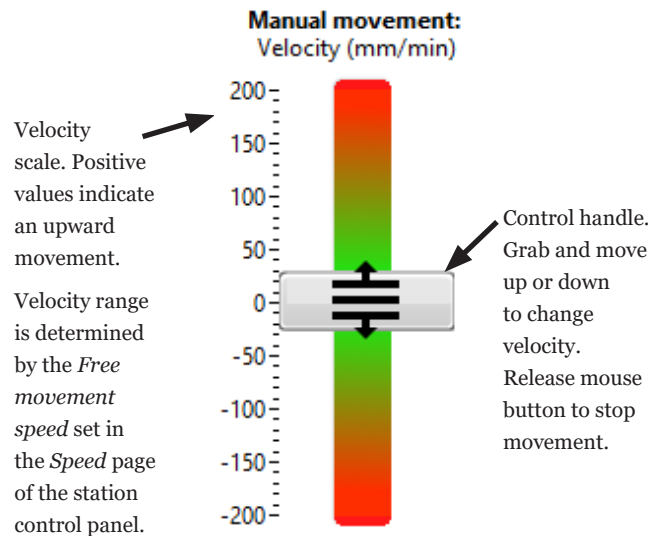
d) Click *Move to Gap*. The movement is an absolute movement from zero position. The sample thickness is always added to the distance to move.

6.8 Manual movement

This chapter describes how the user can position the distance between the compression plates or tension clamps using a manual movement control. Manual movement can even be performed before zeroing is done, which makes it quick and convenient to prepare the positioning e.g. to speed up zeroing by preparing a position close to zero.

Instructions

a) If not already in the setup window for the station, click *Setup* on the relevant test station and click *Test piece and movement*.

b) Click on and drag the manual movement control handle up or down to move the upper plate or clamp up or down. The movement will stop when the mouse button is released. Alternatively, click somewhere on the colored slider to have the velocity be set to the corresponding value. The set velocity is visible in the tip strip next to the control handle.

Velocity scale. Positive values indicate an upward movement.

Velocity range is determined by the *Free movement speed* set in the *Speed* page of the station control panel.

Control handle. Grab and move up or down to change velocity. Release mouse button to stop movement.

6.9 Help

The software has a context sensitive help function. By clicking *Help* or pressing CTRL+H, the help is toggled on or off. The help shows an explanatory text for the function where the cursor is placed.

When hovering the mouse pointer over a function (e.g. input, field, button), a short description is displayed in a yellow text field hovering near the mouse pointer.

6.10 Export Graph

The logger graph can be saved or printed. For a more complete report, instead open the result file and create a report from that (see chapter 7.3).

Click *Report* to open the export/print preview window. The graph can be exported to an image file, printed to a printer or saved to the clipboard.

- To print, click *Print*, which will open the system's print dialog.

- To save to an image file, click *Save image to file*, which will open a file dialog. Select a file name for the export and click *Save*.

- To copy an image of the graph to the clipboard, click *Send to clipboard*.

To display plot names in the graph at each plot, tick *Show plot names*. The plot names can be moved by dragging them to an appropriate location, and an arrow will appear, pointing to the plot from the name.

The header of the graph can be edited even in the print preview window. The annotations can be moved. Graph scale ranges can be edited.

When the file viewer is selected, the selected files in *Open files* are exported. See 7.2 for more info.

6.11 Annotations

Annotations can be made in the graphs, which can be useful e.g. when printing or saving the graph image, to display notes on the graph image.

To edit annotations for the active graph, click *Annotate*, which will open the Annotation window. Enter the text to display. Once added, the size of the annotation can be set by clicking the size selector and selecting a size.

To add another annotation, click *Add*. The annotation can be moved on the graph by dragging and placing it. The annotation can even be moved when in the print preview to adjust it.

Annotations are not saved to the result (log)-file. To remove an annotation, open the annotation window, select the annotation to be removed and click *Remove*. To change the annotation text, double-click on the annotation in the annotation window and edit the text and click *OK*.

Annotation	Text	Text size
+ Add	My note	Medium ⌄
− Remove		✓ Small
		Medium
		Large

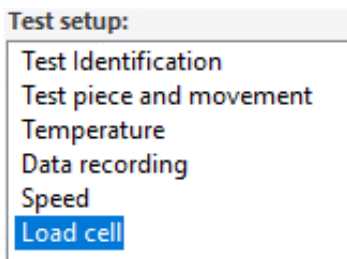# 6.12 Changing Load cell configuration

When a load cell has been changed, it is crucial to also update parameters for that load cell to the load cell amplifier. These parameters include calibration data and range information.

Note! If the load cell configuration is not updated to match the mounted load cell, mechanical failure could occur, and all measurement data will be invalid.

To load the load cell amplifier with a configuration for a load cell, do the following:

Instructions

1. If not already in the setup window for the station, click *Setup* on the relevant test station and click *Load Cell*.

   Test setup:
   - Test Identification
   - Test piece and movement
   - Temperature
   - Data recording
   - Speed
   - Load cell

2. Click *Change load cell*. A file dialog will open and display the folder for the default location for load cell configuration files. Select the file that matches the mounted load cell and click *OK* in the file dialog. You will be asked to verify that the information in the selected file is correct for the mounted load cell. Click *Write* only if you are certain that the information is correct. The configuration is then loaded into the load cell amplifier, and the *Load cell ID* field is updated to display the newly loaded configuration.

3. Perform a zeroing to be able to use the new load cell configuration.

6.13 Options

Additional settings can be configured from the options dialog. Click *Settings* to open the settings dialog, or press CTRL+I.

Application tab

To open the application with a pre-selected method, select "Pre-select method" and select what method to open the application with. The application can also be selected to be opened in full-screen mode.

Tick *Open application in full screen mode* to open the application in full screen mode on launch.

Evaluation tab

Evaluation points can be specified, which will appear in the report. The value for the selected Y scale calculation at the selected times will be included in the report. E.g., if F/F0 is selected for a relaxation file, the calculated F/F0 values for the specified evaluation times will be included.

File tab

In the File tab, the default data folder can be set.

Report

A logo can be set to use when printing and exporting a graph image. Click *Import…* and select an image file. It is recommended to use an image of size of no more than 300 × 300 pixels. If a file is selected but you do not wish to display the logo on the printed page or image file, untick *Use logo*.

The size of the logo on the report page can also be set.

Station tab

In the Station tab, some settings are available that can be changed per station. To select a station to view and change settings for, select the station in the *Station* drop down list.

Note! Inappropriate settings may lead to unexpected results which may lead to load cell failure.

Zero finding tab

In the Zero finding tab, parameters affecting the zero-finding routine can be optimized. It is advised not to touch any setting unless you know what to change and why you need to change it. Please read the help documentation for each setting if you are inclined to change anything.

Note! Inappropriate settings may lead to unexpected results which may lead to load cell failure.

7. Software – Log and Presentation view

7.1 Log view

This chapter describes how the user can configure and use the graph with running log data.

Graph features

For all methods, the graph can show:

• Position
• Force
• Temperature

and in relaxation mode calculate for:

• F/F0

and in creep mode calculate for:

• Creep increment
• Creep index
• Compliance increment

Instructions (functions)

1. Click on the *Logger*, if not already on this view.

2. Click on *Graph Setup* to open the graph setup menu.

3. Click *Time scale* mode to change between linear and logarithmic time scale.

4. Click *Time scale* to toggle time axis between relative and absolute time format.

5. In relaxation method, edit the *t(F0)* value to display a vertical line in the graph for t(F0) when *F/F0* is ticked. F/F0 is calculated using t(F0).

    In Creep method, edit the *t(d1)* value to display a vertical line in the graph for t(d1) when anything else than Position is selected in *Results display*.

    If the time value is updated, the time scale will be set to relative. If for an absolute time scale is needed, set the time scale after changing t(F0) or t(d1).

6. Other graph settings available via the graph settings menu:

    a) *Show Position scale* – toggle all position plots visible/invisible

    b) *Show Force scale* – toggle all force plots visible/invisible

    c) *Show Temp scale* – toggle all temperature plots visible/invisible

    d) *Autoscale All* – set min/max axis values to min/max plot values

    e) *Autoscale Time* – will set min/max axis values according to start/current -time values
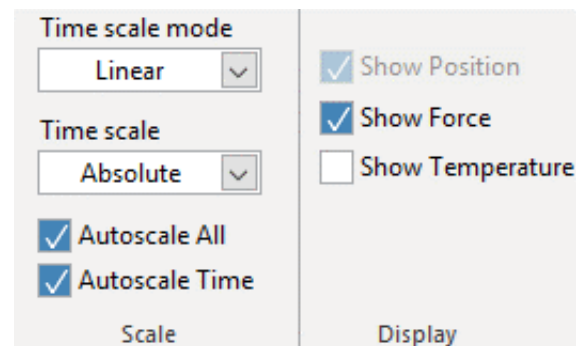
7. The user can set the plot color for each plot. This can be done for each station. To change the color, click the color box next to the indicator for the value (Position, Force, Temp) to bring up the color selector. Click on a color to select it.

    The visibility for the plots can also be set individually. To hide or show a plot, tick the tick box next to the indicator for the value (Position, Force, Temp).
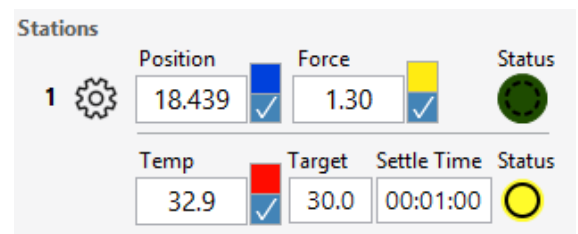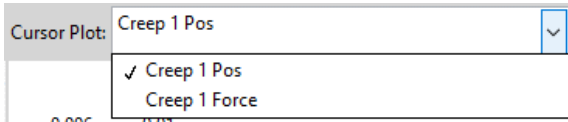
Instructions (Graph tools)

8. To move the cursor, just drag it to where you want. If the graph tool zoom or move has been selected, you will first need to select the cursor tool ⊕ 🔍 ✋.
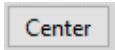
   The cursor will from start select to snap to the first plot. To snap to another plot, select the plot in the *Cursor Plot* drop down selector.

   Cursor Plot: Creep 1 Pos
   ✓ Creep 1 Pos
   Creep 1 Force

   The cursor value is displayed above the graph in the X and Y indicators:

   X: 2016-07-23 11:45:32   Y: 4.81189
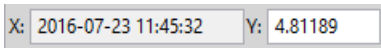
   The cursor can be centered by clicking Center.

   Center

9. Graph tool palette ✛ 🔍 ✋:

   a) Left: cursor tool. Select this tool to be able to drag the cursor in the graph.

   b) Middle: Select the magnifier glass to open a zoom menu and select a zoom function (zoom in/out etc.).

   c) Right: Select the hand tool to move the entire graph within the plot area.

10. To search for a value in a graph, enter a Y-value in the cursor Y-value display and press Enter. The value nearest the specified value will be selected by the graph cursor.

    Y: 4.81189

11. To edit a scale's range on the graph, deselect *Autoscale all*, click on a minimum or maximum scale marker value, and edit a value using the same formatting as the range has.

   -180.00

    -160.00
    00:21:00
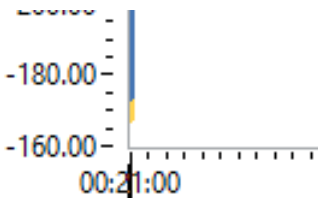
7.2 Presentation view

This chapter describes how the user can open log files, configure the graph and export log file data.

The presentation graph has the same functions as the logger graph except that the report has more features and some graph settings are different.

Differences between the presentation view and log view graph settings:

- Individual plots cannot be colored. Instead, all plots of the same type (position, force, temp) will be of the same color. To change the color, click on Graph setup and click the corresponding color to bring up the color selector.
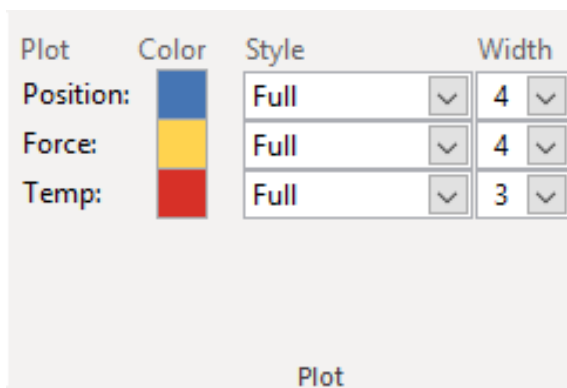
- Plot styles and plot width can be changed from the Graph setup menu.

7.2.1 Open file

Click *Open* and select a file. The default data folder will by default be pre-selected in the file selection dialog.

File selection is limited to the type that the application is currently running in, so e.g. a relaxation file cannot be opened when the application is running in Creep mode.

Multiple files can be opened.

7.2.2 Select file display

Select one or more files in the *Open files* list to see its log data in the graph. The graph will display data in the graph for all selected files. If one file is selected, the file details are displayed under *File details*.

Multiple files can be selected using *Shift*+click to select a range of files, *CTRL*+click to select multiple or *CTRL+A* to select all files.

7.2.3 Close file

Select a file in the *Open files* list and click *Close* to close the selected file.

7.2.4 Export text

Select a file in the *Open files* list and click *Export text* to export all data from the file to a tab delimited text file. The file can then be opened in a text file viewer or a spreadsheet viewer like e.g. Excel.

7.2.5 Report

The selected files in the "Open files" list will be included in the report.

Click *Report* to open the export/print preview window. The graph can be exported to an image file, printed to a printer or saved to the clipboard.

- To print, click *Print*, which will open the system's print dialog.
- To save to an image file, click *Save image to file*, which will open a file dialog. Select a file name for the export and click *Save*.
- To copy an image of the graph to the clipboard, click *Send to clipboard*.

To display plot names in the graph at each plot, tick *Show plot names*. The plot names can be moved by dragging them to an appropriate location, and an arrow will appear, pointing to the plot from the name.

The header of the graph can be edited even in the print preview window. The annotations can be moved. Graph scale ranges can be edited.

When the file viewer is selected, the selected files in *Open files* are exported.

To display a list of details for the reported files, enable "Show details". The first three selected file's details will be listed. A table containing the evaluation points will then also be shown on the report. The evaluation table displays the median value of the files in the report for the selected Y scale calculation. E.g., if F/F0 is selected for a relaxation file, the calculated F/F0 values for the specified evaluation times will be listed. The evaluation times can be edited in the Options window, see chapter 6.13.

8. Temperature calibration

The temperature offset and force with amplifier are at delivery adjusted and calibrated according to the attached calibration certificate. Calibration should be done annually.

9. Service and maintenance

The instrument shall be cleaned on the outside, at regular intervals. The instrument can be cleaned with water and a detergent or ethanol.

The drive belts should be checked for proper tension once a year and replaced if any signs of cracks.

Air pump filter must be replaced every year.

10. Troubleshooting

Check the fuses if the instruments does not respond to power on.

2 main fuses are located on the power inlet for the main power cord.

The fuses are rated 10 Amp slow 230 VAC.

Before changing a defective fuse, check for any possible short circuit, causing the fuse to burn.

11. Set air exchange rate

According to standards the air has to be changed during the test.

ISO 188 Accelerated ageing, method A, requires an air change of 3 to 10 times an hour.

IEC 811 Ageing of cable insulation, requires an air change rate of 8 to 20 times an hour.

The cells in the oven have a volume of 1,3 l/cell. This gives the following flow of air through the flow meters:

air change rate	
changes/h	l/min
3	0,07
5	0,11
7,5	0,16
10	0,22
12	0,27
15	0,32
17,5	0,38
20	0,43

For ageing of rubber materials we suggest to set the flowmeters to 0,15 l/min.

For ageing of cable insulation materials we suggest to set the flowmeters to 0,3 l/min.

Read the flow of the flowmeters at the center of the floats. The floats shall rotate slowly to show the correct reading.

Note: If the floats does not rotate properly check if the oven is placed horizontally.

Formula to calculate airflow in litres/min

$$\frac{\text{Volume} \times \text{Air} \times \text{changes}}{\text{time [60]}} = \text{Airflow on metre}$$

$$\text{Ex} \quad \frac{1.3 \times 10}{60} = 0{,}2166 \sim 0{,}22 \text{ l/min}$$

12. Safety

Note: Use gloves when the samples are placed in the oven or removed from the oven.

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

- Standard laboratory temperature of either 23 °C ± 2° or 27 °C ± 2°.

- Humidity not more than 90 % RH – non condensing.

- Other environmental aspects: Pollution degree 2 – Laboratory environment.

13. Technical specification, EB 18-II-3 (3 test stations)/HT/HF

Temperature range, °C:	+40 to +200 (+300 for HT-version)
Temp. control, +40 to +100 °C, °C:	± 0,5
+101 to +200 °C, °C:	± 1,0
+201 to +300 °C, °C:	± 1,5
Temp. variation in time, °C:	± 0,25
Temperature sensors:	Pt 100, 1/3 DIN
No. of temperatures:	3
No. of cells:	3
Air speed, m/s:	<0,001
Air changes, changes/hour:	3 to 20
Force range compression, N:	0 to 1 000 (alternatively 100, 500 or 1 500), (2 000 for HF-version)
Force range tension, N:	100 (tension is optional)
Force resolution, N:	0,1 in compression and 0,01 in tension
Force accuracy, N:	0,2 (0,02, 0,1, 0,4)
Displacement resolution, mm:	0,0001
Displacement accuracy, mm:	0,003
Speed range, mm/min:	0,1 to 200
Compression plate, mm dia:	50
Power, W:	1 200
Voltage, V/Hz:	220–240/1/50, or 110–120/1/60

Materials

Compression plates:	Stainless steel
Compression rig:	Stainless steel and aluminium
Casing:	Powder painted steel
Size, w × d × h, mm:	1 170 × 500 × 1 220
Weight, kg:	151
Standards:	ISO 188 method A, ISO 3384-1 method A, ISO 6914, ISO 899 with modification

Common specifications:

- The oven perform well inside the apparatus requirements in ISO 188, IEC 811 and other equivalent standards.

- The oven is controlled from a PLC (with a colour touch screen).

- Special design with controlled air exchange rate and low air speed.

- The casing consists of steel, painted with powder paint in bluegreen colour.

- The inner cells are made of aluminium.

- Temperature controller with 0,1°C setpoint (PLC).

- Fixed over temperature fuse.

- Flowmeters with needle valves, for setting the air exchange rate.

- The air speed is low and is dependent on the air exchange rate only, as specified in ISO 188 method A.

- Alarm for low air pressure (PLC).

- Built in air pump.

- Cooling channels in the casing for low surface temperature.

- Temperature controlled cooling fan for the electronics cabinet.

- Indication of power failure (PLC).

- Run-time meter (PLC).

- Countdown timer (PLC).

- Microfilter for the air which removes 99,99 % of all particles over 0,1 µm.

Options

For rebuilding the rigs to tension

EB 02.02   Grips for testing relaxation in tension, according to ISO 6914.

EB 02.03   Load Cell 100 N for tests in tension, including adapters.

For testing in liquids

EB 02.01   Container and pressure plate (with a hole in the centre) for measurement in liquids, according to ISO 3384.

EB 02.01P Sealed container for testing of stress relaxation in volatile liquids and coolants up to 3 Bar pressure (maximum 150 °C).

Support

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