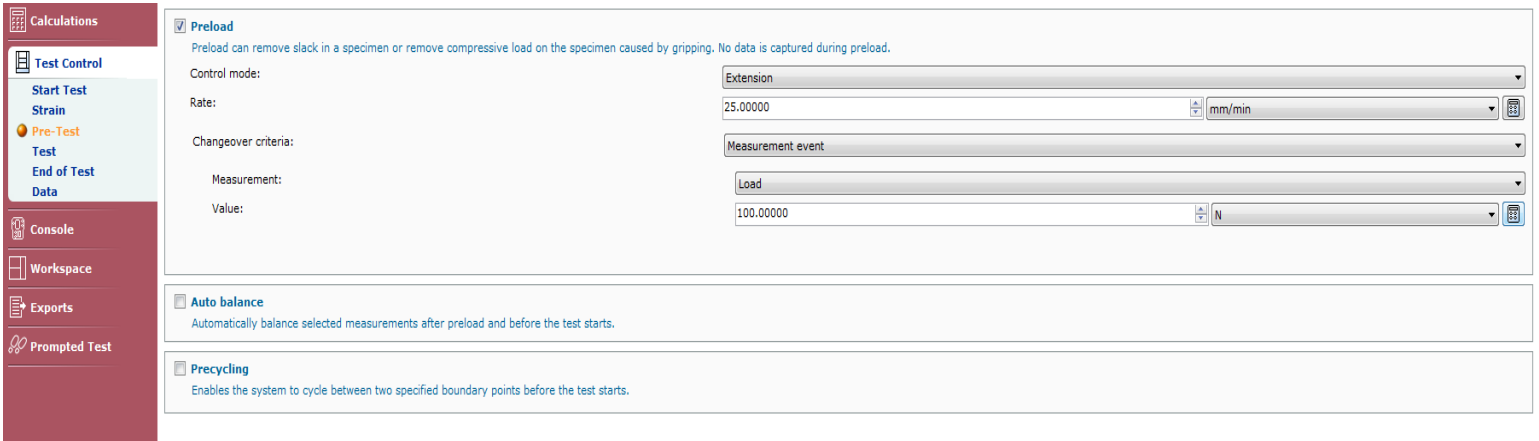


SETTING PROPORTIONAL GAIN FOR LOAD CONTROL

(CREEP TESTING) - BLUEHILL 3

When running in load control, shaking or vibration coming from the machines motor can occur. This is due to the proportional gain factor (feedback) being set incorrectly. **The proportional gain factor is material specific.** Tuning the gain setting will adjust how quickly the Instron frame's motor reacts to changes in force measured by the load cell. The procedure below must be carried out for each different material or sample type. This includes the same material or specimen type while conditioned to different temperatures (heated or cooled). In that case, the procedure below must be followed while test specimens are soaked in the temperature desired for the creep testing.

1. Create a method with the same test type. (Ex. If a compression creep test, create a regular compression method)
2. Under **Test Control** → **Pre-test**, set a preload up to the value (extension, load or otherwise) you wish to begin your creep/hold with.
 - a. Set Control mode to **extension**.



The screenshot shows the 'Preload' settings in the Instron software. The 'Preload' checkbox is checked. Below it, the 'Control mode' is set to 'Extension', the 'Rate' is 25.00000 mm/min, and the 'Value' is 100.00000 N. The 'Changeover criteria' section shows 'Measurement event' set to 'Load'.

Preload
Preload can remove slack in a specimen or remove compressive load on the specimen caused by gripping. No data is captured during preload.

Control mode: Extension

Rate: 25.00000 mm/min

Changeover criteria: Measurement event

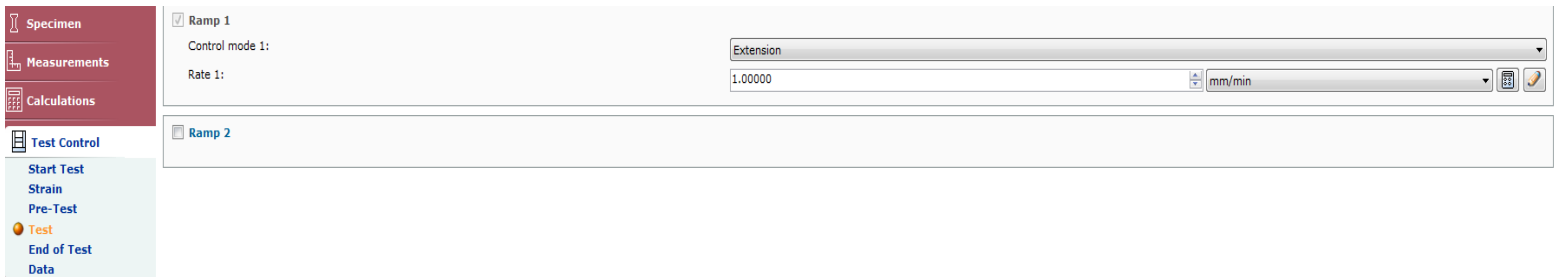
Measurement: Load

Value: 100.00000 N

Auto balance
Automatically balance selected measurements after preload and before the test starts.

Precycling
Enables the system to cycle between two specified boundary points before the test starts.

3. Under **Test Control** → **Test**, set **Ramp 1** to be a significantly slow test rate with control mode as **extension**. (1 mm/min is sufficient in most cases)



The screenshot shows the 'Ramp 1' settings in the Instron software. The 'Ramp 1' checkbox is checked. The 'Control mode 1' is set to 'Extension' and the 'Rate 1' is 1.00000 mm/min.

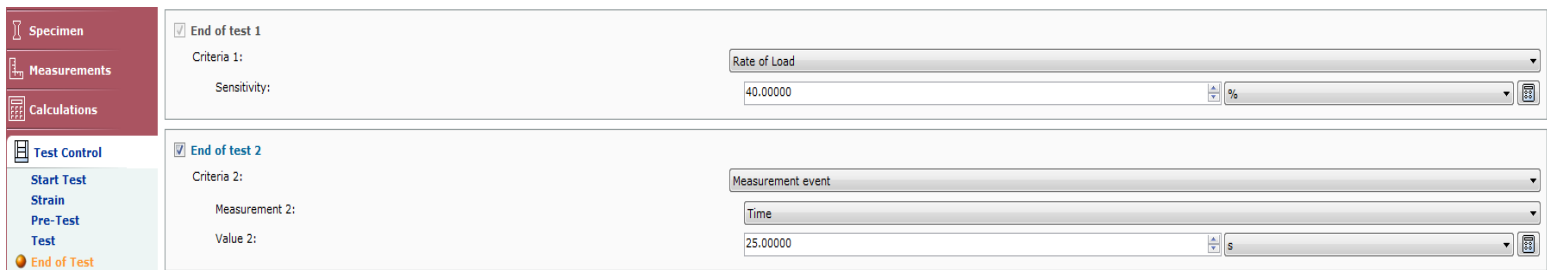
Ramp 1

Control mode 1: Extension


Rate 1: 1.00000 mm/min

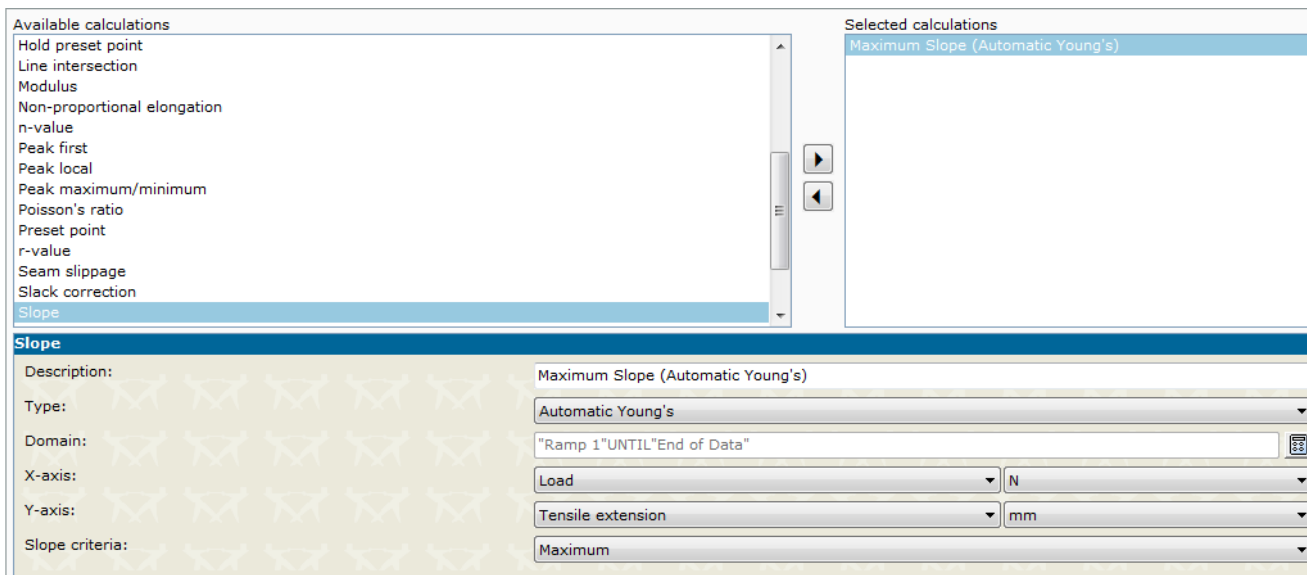
Ramp 2

4. Now go to **Test Control** → **End of Test**, and set **End of Test 2** to be a measurement event based on **time**.
 - a. 20-30 seconds should be enough to get a consistent, linear plot.



The screenshot shows the 'Test Control' section of the software. Under 'End of Test 2', the criteria is set to 'Measurement event', the measurement is 'Time', and the value is 25.00000 seconds. The 'End of Test 1' criteria is set to 'Rate of Load' with a sensitivity of 40.00000%.

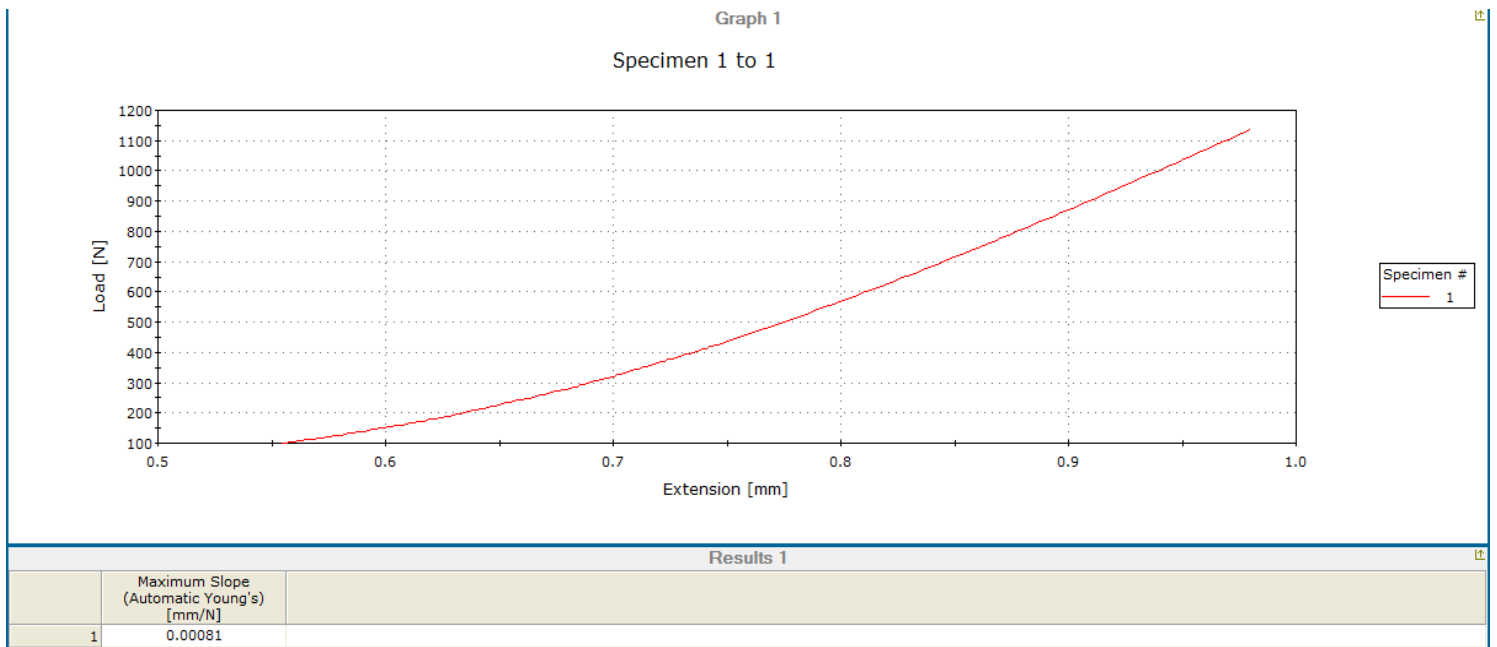
5. In the top right hand portion of the screen, click the load transducer icon (). This will open up a new window.
 - a. Click the **Gain tab**.
 - b. Change the dropdown to **Override default settings**
 - c. Look for proportional gain factor. Check to see what the units are. (It will be some form of load/extension)
 - d. Close out of the transducer settings
6. Go to Calculations. Under available calculations select **Slope**.
 - a. Keep the type as **Automatic Young's**/Keep domain as is
 - b. Change X-Axis to **Load**. Change the units of the X-Axis to match the load units of your proportional gain factor.
 - c. Change the Y-Axis to **tensile** or **compressive extension**. Change the units of the Y-Axis to match the extension units of your proportional gain factor.
****If your units cannot be matched, go to General and change the System of Units to All****
 - d. Keep slope criteria as **Maximum**




The screenshot shows the 'Calculations' window. In the 'Available calculations' list, 'Slope' is selected. In the 'Selected calculations' list, 'Maximum Slope (Automatic Young's)' is selected. The configuration for 'Slope' is as follows:

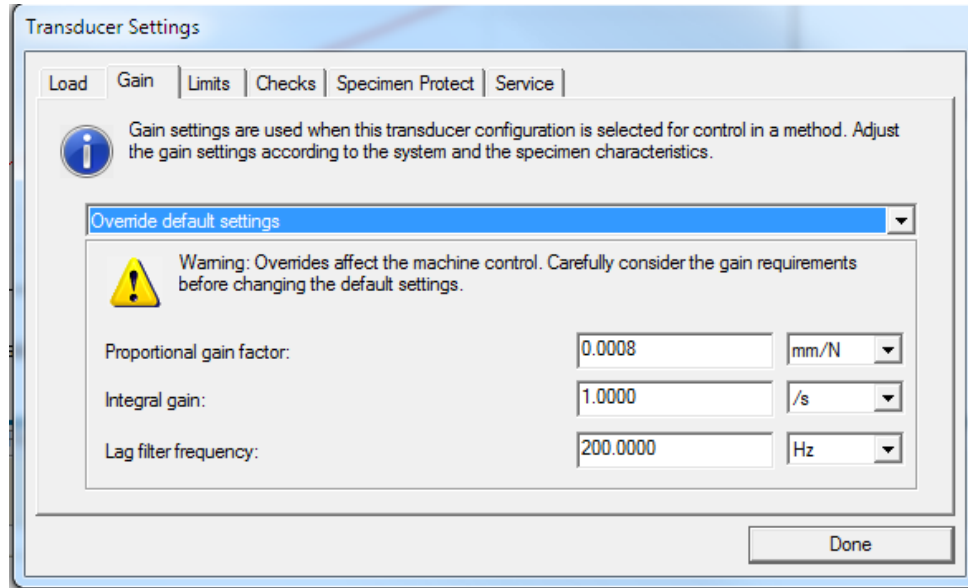
Description:	Maximum Slope (Automatic Young's)	
Type:	Automatic Young's	
Domain:	"Ramp 1"UNTIL"End of Data"	
X-axis:	Load	N
Y-axis:	Tensile extension	mm
Slope criteria:	Maximum	

7. Go to **Workspace → Results 1** – Under available results **expand Maximum Slope (Automatic Young's)** and double click on **Slope**. This will be the only result needed from this method.
 - a. Below Selected Results, make sure your units are load/extension. (ex. mm/N)
 - b. Keep the maximum number of digits.
8. Now, save this method, and open up a new sample with this method.
9. Run the test. **Again, make sure you are using the exact material that will be used in your load control test.** Below is an example of a populated graph and results table.
 - a. Running 2 or 3 test specimens is recommended to obtain an average slope value.



10. Make note of the slope value. This is your Proportional Gain Factor.

- a. Go back to your Load Transducer Settings ().
- b. Click on the Gain Tab.
- c. Change the dropdown selection to Override Transducer Settings.
- d. Enter your slope result as the Proportional Gain Factor.



The proportional gain factor is now set for the material being tested. Far more often than not, this value will deliver consistent results. If you still notice your load rate is off or vibration in your machine you may need to tweak the number. At this point, the slope value has given you a very precise ballpark value.