

Temperature Calibration Procedure

How to use

This application requires the Internet Explorer 6.0 browser, or the use of the "compatibility mode" for further versions, to access the experiment and LabVIEW 7.1 or LabVIEW 7.1 Run-Time. To download LabVIEW 7.1 Run-Time click on the following link: <https://remotelab.fe.up.pt/LVRunTimeEng.exe> (only for Windows).

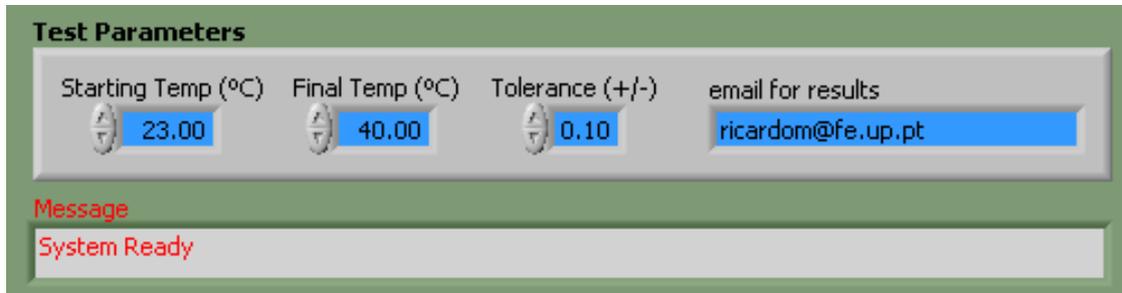
After making your reservation for this experiment through the booking application, your browser should present the user interface and the real-time video.

The screenshot displays the 'Temperature Calibration Procedure' software interface. At the top, there is a title bar with 'Edit Operate' and a small icon. Below the title bar, the interface features the FEUP (Universidade do Porto) and LIM (Laboratory of Instrumentation for Measurements) logos. The main title 'Temperature Calibration Procedure' is prominently displayed. The 'Test Parameters' section includes input fields for 'Starting Temp (°C)' (25.00), 'Final Temp (°C)' (40.00), and 'Tolerance (+/-)' (0.10), along with an 'email for results' field and a 'START' button. A 'Message' box shows 'System Ready'. The 'Stabilization status' section provides real-time data: 'Set Point (°C)' (0.00), 'Iteration' (0), '+ Deviation (°C)' (0.00), '- Deviation (°C)' (0.00), and 'Volume (l)' (5.6). The 'Average Results' section shows three columns of 0.00 values for 'Temperature (PT100 bath °C)' and 'System under calibration (V)'. A 'Live video' window shows a digital display reading 27.9. A 'Control granted' message is displayed in a yellow box. A graph shows 'Voltage (V)' on the y-axis (ranging from 2.38 to 2.62) and 'Time' on the x-axis (ranging from -1 to 1). The graph area is currently blank. The interface also includes a 'TIME OUT' indicator showing 14:24 and a 'Version 1.2' label at the bottom right.

The message **Control granted** confirms that you have control of the experiment. You may now start by introducing the **Test Parameters**:

- **Starting Temp (°C)**: Specifies the starting temperature of the current test (lower limit of the calibration interval)
- **Final Temp (°C)**: Specifies the ending temperature of the current test (higher limit of the calibration interval)

- **Tolerance (+/-):** Specifies the temperature error interval allowed around the setting points
- **email for results:** Sends the test results to the address introduced



After setting the different parameters, press the **START** button. The software will then automatically perform the established procedure (dividing the temperature range into two intervals, with three setting points):

- First Setting Point = Starting Temp (°C)
- Second Setting Point = Starting Temp + (Final Temp – Starting Temp) / 2 (°C)
- Third Setting Point = Final Temp (°C)

The **Stabilization status** information allows the user to follow the temperature calibration procedure during system evolution towards each setting point:

- **Set Point (°C):** The current setting point value
- **Iteration:** The number of attempts to stabilize the temperature at the current setting point within the tolerance
- **Deviation:** The positive/negative difference between the setting point value and that of the element reference temperature
- **Volume:** The water volume (in litres)

The **Experiment Steps** bar notifies the user on the present stage of the experiment for each setting point:

- **Configuration:** Configuration of the hardware according with the settings
- **Heating:** The PID controller is heating the water bath
- **Waiting:** Delay after heating and before taking any measurement, to allow the temperature to become uniform

- **Stabilization:** During each cycle the temperature is checked ten times; if all the values are inside the tolerance, then it proceeds; otherwise it will wait a bit more and try again

The **System under calibration** window displays a **Voltage (V) vs. Time** plot of the temporal evolution of the output signal of the temperature sensor under test.

When the **Temperature Calibration Procedure** finishes, the **Average Results** are presented.

Average Results		
25.05	32.65	40.04
2.01	2.32	2.61

Each column shows the average value of the measured temperature (top) and the corresponding average value of the measured output signal for the Pt₁₀₀ transmitter (bottom).

Temperature Calibration Procedure

Test Parameters

Starting Temp (°C)	Final Temp (°C)	Tolerance (+/-)	email for results
30.00	35.00	0.10	ricardom@fe.up.pt

TIME OUT 4 : 10

START

Message
Experiment has finished

Stabilization status

Set Point (°C)	Iteration	+ Deviation (°C)	- Deviation (°C)	Volume (l)
35.00	0	0.06	0.09	5.5

Average Results

30.02	32.59	35.04	Temperature (PT100 bath °C)
2.19	2.31	2.40	System under calibration (V)

Live video
35.1

Experiment Steps

- Stabilization -
- Waiting -
- Heating -
- Configuration -

Voltage (V) vs. Time

2.40	System under calibration
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Version 1.2

At the end of the experiment, the user is notified by email, if the email address has been introduced. The information sent includes all individual values, as well as the average values.

	A	B	C
1	Temperature Reference (°C)	System Under Calibration (V)	
2	28	2.103	
3	28.14	2.106	
4	28.1	2.109	
5	28.07	2.111	
6	28.06	2.113	
7	28.04	2.114	
8	28.08	2.114	
9	28.05	2.117	
10	28.03	2.117	
11	28.02	2.118	
12	30.13	2.186	
13	30.09	2.19	
14	30	2.191	
15	30.02	2.197	
16	30.01	2.196	
17	30	2.198	
18	30.13	2.196	
19	30.11	2.198	
20	30.06	2.2	
21	30.04	2.203	
22	32.1	2.263	
23	32.06	2.264	
24	32.06	2.27	
25	32.01	2.271	
26	32.03	2.268	
27	32.03	2.27	
28	32.02	2.272	
29	31.96	2.273	
30	32.05	2.277	
31	32.07	2.276	
32	Average Values		
33	28.1	2.1	
34	30.1	2.2	
35	32.0	2.3	
36			