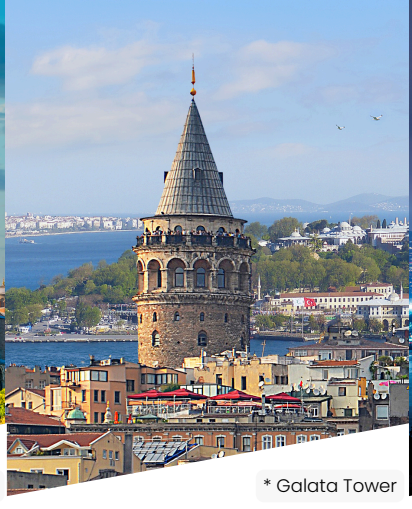


* Hagia Sophia



* Galata Tower



* Bosphorus Bridge

# MASTERCLASS

## TEMPERATURE MEASUREMENT: What Every ISO/IEC 17025 Testing Laboratory Should Know?

**Organized by:**

turklab
Kalibrasyon ve Deney Laboratuvarları Derneği

**Supported by:**

eurolab

**Turkish Lloyd Foundation Tuzla Campus, ISTANBUL, TÜRKİYE**

**16 - 18 November 2026.**

**European Centre for Laboratory Excellence d.o.o.** (EC4LE) is a non-profitable, non-governmental organisation which deals with metrology, testing and technical regulations. They have been actively involved in training of laboratory personnel, with over 350 courses organised in the last 25 years.

EUROPEAN CENTRE FOR LABORATORY EXCELLENCE

## ABOUT THE MASTERCLASS

This three day training in English is based on practical knowledge and real-world examples is being designed for professionals from ISO/IEC 17025 accredited testing laboratories and other industries where precise and reliable temperature measurement is essential. It is suitable for: **technicians • analysts • quality managers • heads of laboratories** who want to build a strong foundation in temperature measurement principles, gain practical skills, and ensure compliance with ISO/IEC 17025 and other international standards.

While temperature measurement may seem straightforward, it involves a wide range of principles across seemingly similar measuring equipment. Understanding these differences is crucial, as errors in temperature measurement are among the most common issues encountered in laboratories. Such errors can directly affect the accuracy and reliability of final laboratory results and sometimes cause costly mistakes.

Each participant will receive a certificate upon completing the training, recognizing their newly acquired knowledge and skills.

## DAY 1 TIMETABLE

### EVERYTHING YOU NEED TO KNOW ABOUT TEMPERATURE EQUIPMENT CALIBRATION CERTIFICATES AND MEASUREMENT UNCERTAINTY

**On day one you will learn what is actually calibration and measurement uncertainty, what is the difference between calibration and verification, and between accreditation and authorisation. You will learn what are the important elements of calibration certificates, how to interpret and use these documents, and how by doing it you can improve your own accuracy. You will learn how to manage your measuring equipment efficiently and you will acquire a deep understanding of the measurement uncertainty. You will learn about its components and how to use tolerances and corrections. You will find out how to set up criteria for your internal equipment checks and the basics about transfer of measurement uncertainties from calibration certificates to your own methods.**

**You are welcome to bring your own calibration certificates for your own equipment and we will discuss them, apply together what we have learnt and help you to improve your own measuring equipment management system.**

| | |
|---|---|
| **09:00 - 10:30** | Introduction. Terminology. Calibration, testing, verification. Accreditation and authorisation. Signs and symbols. Client perspective. |
| **15 min** | **Break** |
| **10:45 – 12:00** | Elements of calibration certificates. Differences between measuring instruments and temperature setting equipment. Determination of calibration points.Determination of calibration intervals. Calibration location. Traceability. |
| **1h** | **Lunch** |
| **13:00 – 14:30** | Interpretation of calibration results and measurement uncertainty. Results' formats depending on the instrument type. What is measurement uncertainty made of. Tolerances and corrections. |
| **15 min** | **Break** |
| **14:45 – 16:00** | Transfer of measurement uncertainty from calibration certificates to your own methods. Internal checks. Real-world examples. Exam. |

## DAY 2 TIMETABLE

### THERMOMETERS AND HOW TO CORRECTLY USE THEM

**Temperature measurement is everywhere, and often the most important measurement in many types of laboratories and industry processes. Despite that, significant errors in measurement are common because of the lack of information about thermometer types and the basic principles of their work. These errors are much more common compared with other physical parameters measurement (e.g. mass or length) because temperature is never measured directly. What is actually measured is the change of some property, like electrical resistance or volume.**

**You will get acquinted with many different types of thermometers and learn how to choose them and use them. Also, you will learn a lot about the most common errors in measurement and why they happen in all the types of thermometers you use in your work. After the training you will be able to improve the accuracy and reliability of your own measurements. Through practical work you will get demonstration of some surprising properties and problems in use of glass thermometers, thermocouples, resistance thermometers and infrared thermometers.**

| | |
|---|---|
| **09:00 - 10:30** | Basic concepts and history. What is temperature? Short history of thermometry and temperature units. Triple point of water. Heat and temperature. Kinetic theory of gases. ITS-90 temperature scale. Heat transfer – conduction, convection and radiation.<br><br>Types of thermometers. General errors in temperature measurement using thermometers. Immersion error. Heat capacity error. Response time error. Temperature change error. Thermal radiation error. |
| **15 min** | **Break** |
| **10:45 – 12:00** | Glass thermometers – in general. Parts of a glass thermometer. Capillary liquid and its properties. Types of glass thermometers by intended immersion. Types of glass thermometer by construction. Standards. General measurement errors. Pressure-related errors. Reservoir change errors. Capillary stickiness errors. Capillary liquid disconnection errors. Meniscus errors. Parallax errors. Immersion errors. Pros and cons of glass thermometers. How to choose the range and type. Storage of glass thermometers. Practice: Error calculation related to improper immersion. |
| **1h** | **Lunch** |
| **13:00 – 14:30** | Digital contact thermometers – thermocouples, resistance probes and thermistors in general. Bimetal thermometers.<br><br>Thermocouples. How thermocouples work – thermoelectric effects. Seebeck effect and temperature measurement. Why there is no perfect thermocouple. Standard thermocouple types. General measurement errors. Inhomogeneity errors. Reference junction errors. Linearisation errors. Correct use of thermocouples. Practice: Temperature measurement with a thermocouple and a voltmeter using conversion tables.<br><br>Resistance thermometers. How resistance thermometers work. Impurity effects. 2-, 3- and 4-wire resistance thermometers. General measurements errors. Self-heating errors. Mechanical effects errors. Stretching errors. Contamination errors. How to choose a resistance thermometer. Thermistors. |
| **15 min** | **Break** |
| **14:45 – 16:00** | Infrared thermometers. How IR thermometers work radically different from contact thermometer. Emission, reflection and transmission. Black body. Wavelengths. Unknown sensor problem. Signal transmission problem. Signal processing problem. Measurement errors. Emissivity erors. Reflection errors. Absorption errors. Scattering errors. Optical components errors. Environment temperature errors. Linearisation errors. Chosen emissivity errors. How to choose an IR thermometer. |

## DAY 3 TIMETABLE

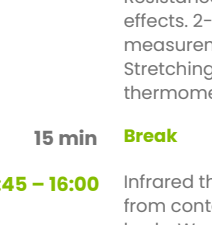
### TEMPERATURE ENCLOSURES – INTERNAL CHECKS AND CALIBRATION

**During the final day we will take a closer look into the all temperature chambers from labs and industry – refrigerators, freezer, incubators, dry ovens and dry sterilizers, plus the basic specificities of similar equipment like climatic chambers, thermal baths and autoclaves.**

**After the training you will learn all the concepts needed to understand calibration results, and for your own design and execution of qualification, temperature mapping and especially internal checks of temperature enclosures. We will go through the most imporant and practically applicable elements of EU guidelines and legislation and confirm what we have learn through practical work.**

| | |
|---|---|
| **09:00 - 10:30** | General concept of temperature chambers' quality assurance. Calibration of non- measuring instruments. Calibration points. Calibration location. Calibration intervals. Specificities of calibration depending on the type and range of temperature chambers (from refrigerators to furnaces). Other enclosures – climatic chambers, thermal baths, dry wells.<br><br>European guidelines EURAMET cg-20. German guidelines DAkkS DKD-R 5-7. Spatial inhomogeneity. Temperal instability. Thermal radiation influence. Loading effects. Various types of measurement uncertainties related to temperature chamber calibration. |
| **15 min** | **Break** |
| **10:45 – 12:00** | Expected values of temperature chamber parameters for refrigerators, freezers, incubators, dry ovens and dry sterilizers. Elements of traceability. Practice: Determination of temperature chamber parameters and measurement uncertainties for a freezer. |
| **1h** | **Lunch** |
| **13:00 – 14:30** | Qualification and validation of temperature chambers. Good practice. Terminology. URS (User Requirement Specification). Generally applicable elements of EudraLex EU legislation. Installation qualification (IQ). Operation qualification (OQ). Performance qualification (PQ). Open door test and power failure test. Temperature mapping. World Health Organization requirements. Validation of transport. Autoclaves. |
| **15 min** | **Break** |
| **14:45 – 16:00** | Temperature chambers' internal checks. Practice: Freezer internal check using 3 thermometers. |

## ABOUT THE LECTURER



**Siniša Prugovečki** is the general manager and founder of Metroteka, ISO/IEC 17025 accredited calibration lab with 30+ accredited calibration methods. He graduated astrophysics on the University of Zagreb in 2001. and was a board member of Croatian Metrology Institute from 2009. until 2013. He was also a board member of the Croatian Society for Quality for 7 years. and a member of the International Metrology Federation (IMEKO)'s technical committee TC6 on digitalization for 3 years. Currently he is the President of the Croatian Metrology Society; also a founder of the LorisQ - a new generation app for measuring equipment management.

## HOW TO JOIN US

The registration fee for this Master Class is €900. Three lunches and six coffee breaks are included in the registration fee. In order to maintain the high quality and interactive nature of the training, the number of participants is limited.

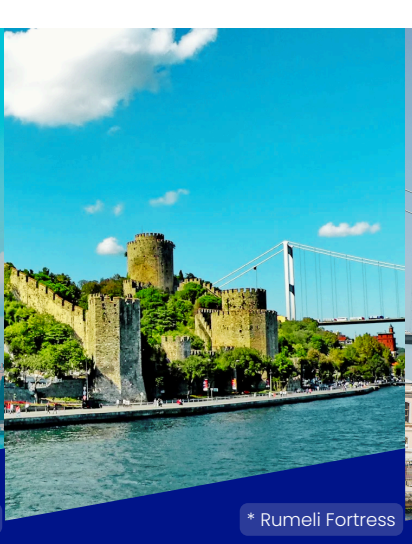
You can complete your registration for the training via the link below:
**https://forms.gle/j6UxEzh5hE3unMma9**

For detailed information, please visit **www.turklab.org/en/** and for any inquiries, please contact us at info@turklab.org.

www.ec4le.eu



* Maiden's Tower



* Rumeli Fortress



* Dolmabahçe Mosque