

ELA212 Instuderings frågor

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I. STUDY QUESTIONS BLOCK 1

A. 1. What does calibration mean in the context of electrical measurement systems, and why is it important?

To calibrate a system is to readjust the output to fall in line with a known input value. This is done by changing internal values or models to fall in line across a designated range.

Without calibration the system will give skewed outputs and be unreliable.

B. 2. Describe the basic steps in a typical calibration process.

Input a known variable into the system, adjust the values of the system to align with the calibrator. Rinse and repeat until a satisfactory accuracy is achieved.

C. 3. What is the difference between accuracy and precision in a measurement system?

Accuracy is how close to a true value a measurement is.

Precision is how big your error of the same measurement is.

D. 4. Explain the concepts of traceability and uncertainty in measurement and how they affect calibration.

Traceability is the practice of noting the environmental and time aspects of any calibrations and measurements to account for any such factors in the future.

Every system has some level of uncertainty and you are not able to calibrate the system more accurately than the systems uncertainty.

E. 5. What are the common reasons why a measurement system needs calibration?

Any system which is not self-calibrated will drift and most will be dependant on environmental factors (degradation of components, ambient temperature/moisture). These things will need to be adjusted for and said process is called calibration.

F. 6. What is a calibration standard, and why is it important to use standardized references?

A set of guidelines and procedures to calibrate a system which are often tailor made for the system in question.

By having an official way to calibrate a system it allows comparisons be made across systems without having to dive into what system of calibration said system used.

G. 7. Describe how a multimeter is calibrated and which parameters are checked during the process.

A multimeter is connected to a reference Voltage/resistance/current, measure it using the multimeter and adjust the internal setting of the multimeter to align with the reference.

H. 8. How is measurement uncertainty affected if a measurement system is not regularly calibrated?

The uncertainty of a system will continue to deviate with time.

I. 9. What is a "zero point calibration," and in what situations is it used?

Whenever a system is calibrated along the zero value of the system. A system with no input ought to output 0 and all other measurements can be judged from it. (assuming the system is correctly linearly calibrated). This is used whenever a systems output characteristics are true but are displaced.

J. 10. Explain the difference between static and dynamic calibration of measurement systems.

A static calibration is done with a non-changing reference and gains you a single data point. (At x input -> Y output).

A dynamic calibration is done with a changing reference and gains you a graph worth of data. (At X input -> y(X) output). This can be done live to use different mathematic depending on the range the input the system is currently measuring.

K. 11. What is the difference between absolute calibration and relative calibration?

A relative calibration is calibrated against a certain calibration reference and can differ from other relative calibrated systems depending on the calibration reference and the environmental factors when it was done.

An absolute calibration correlates the values given of a system with a physical constant or other directly observable or mathematically derived values.

L. 12. Provide examples of how environmental factors, such as temperature and humidity, can affect the calibration of electrical measurement systems.

If the temperature deviates the measuring components will react differently to electrical values.

Other physical values are also dependant on temperature and the like. The density of a material will change along with temperature while the boiling point of liquids are dependant on the pressure.

M. 13. What role do calibration certificates play, and what should be checked on a calibration certificate?

It is a collection of information about the instruments calibrations. This usually includes but are not limited to

- Title: The certificate name
- The details of the laboratory tasked with the calibration
- Customer details
- A unique identification code for the calibration certificate
- The device name and details
- Details on the environmental conditions where the calibration took place
- Calibration results with respective sign conventions
- Name, designation, identification, and signature of the person in charge of the calibration
- A statement that specifies these test results are only relevant to this specific device
- Evidence that the measurements are traceable

The more important things to look for would be the environmental conditions, the calibration results and the traceability of the measurements.

N. 14. Explain how an uncertainty budget is established for a measurement system and its role in calibration.

A uncertainty budget is a breakdown of how big the effects of different sources of uncertainty has on a system. It can guide the user to which factor should be calibrated for first in case the system is faulty.

O. 15. What is the “calibration interval,” and how are suitable calibration intervals determined for a measurement system?

The calibration interval is how often a system needs to be recalibrated to ensure a level of certainty. This interval is dependant on the fastest deviating component.