Hochschule für Angewandte
Wissenschaften Hamburg
Hamburg University of Applied Sciences

Module

Electrical Engineering 1

Degree programme:
Bachelor Course Information Engineering

Manual for the Laboratory

Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

Content

Scope 2

Responsibilities 3

Role of team leader 3
Role of assistants 3

Reporting Guidelines 3

Presenting data 4

Raw data 4
Graphical presentation of data 4

Systematic set up of circuits 5

Procedure 5

Scope

This document describes the responsibilities, reporting guidelines and general rules to set up an experiment for the laboratory session. This document must be read and understood by each participant of the group.

Responsibilities

Laboratory work is team work: in our measurement lab a team is formed by three persons: the team leader (L1) and two assistants (A2, A3). Students are free to choose their team - only in special cases we may replace the members. Each team member has to be at least once in the semester the team leader.

Role of team leader

The team is responsible for all calculations to be done prior to the lab period, though it is highly recommended that the team is preparing all experiments and the calculations together. The team leader will present all circuit diagrams and prepared graphs in the beginning of the lab session. He is in charge of the presentation of all results and a correct final report to be presented directly after the lab hours.

In case that the team leader is prevented for health reasons (medical certificate required) he informs the assistant before the lab starts. It is expected that the team members are familiar with the lab and have enough details to execute the lab test.

Role of assistants

The assistants must be prepared as well and must know all necessary details about the experiment and the specification list of all instruments to be used. They start immediately while the team leader is presenting the prepared documents and set all equipment needed for the task. They calibrate and adjust the zero point. They are in charge of the measurement and follow the advice of the team leader, connect the circuit due to the circuit diagram and read the results. The person who carried out the measurements is documented in the report.

Reporting Guidelines

A report of experimental work should address the following topics that can be used as general guideline for the content:

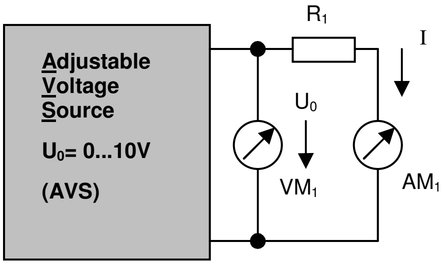
1. Title
   Name/No of experiment, team members, date
2. Goal
   Short description of intention of the experiment and the theoretical background. This is the place for the prepared calculations. A list of the questions to be answered by the experiment. Later the evaluation and discussion will refer to these questions.
3. Theory
   Describe the theory and the precalculation of the expected measurement results.
4. Measurement description
   Measurement setup, actual wiring diagrams including all instruments being used plus a list of serial numbers, models and measuring ranges - done by the team leader prior to the lab course, a detailed description of measurement or simulation steps

   Note:
   Anyone who reads this chapter must be able to carry out the experiment in exactly the same way.

   Examples for information to be documented: who carried out the measurement, wiring diagrams, equipment serial numbers and models, unusual instrument behaviour if it occurs

   Remember: Who, when, what, which instrument?

Example for wiring diagram and documentation:



Meter No	Model	Serial No	Value
VM_1	MetraHit	Xy 002	
AM_1	Keithley	Amu45	
AVS	Adjust. Voltage Source	VHS 3	
R_1	Precision resistor	R24	1.000 Ω

5. Results
   Documentation of the original measurement results and analysis of the measurement results, diagrams and calculations with explanations. If required a discussion of the measurement errors based on the methods of error propagation.
6. Discussion
   The evaluation of the measurement results will be compared with the theory. Any discrepancy should be explained. Finally, a short part sums up the results of the discussion and is answering the questions.

Management summary
In industry and science it is always a good idea to sum up the key findings in a short management summary. This abstract is likely to be read by higher-level managers and other users who are scanning reports for possible information contained in the report body. The full report will usually be read by those needing specific information contained in the report or by those wanting to reproduce the measurement. They are interested in the details of the data sheets, the analysis of the level of accuracy, and the calculations and results that support the conclusions and recommendations. For these readers, the references from which source material and information were obtained should also be provided.

Presenting data

Raw data

The measurement data should be **tabulated** in a prepared table, properly identified and **simultaneously plotted** (see 'graphical representation' below) as a graph before the next measurement in order to avoid human errors by misreading.

The report to be presented at the end of a measurement should also be **carefully prepared in advance**. Its objective is to explain **what** was done and **how** it was accomplished. It should give the results that were obtained as well as an explanation of their significance.

Note:
Do not write down what should have been done but what you have done. Avoid personal pronouns as 'I did ...' or 'we made...' - better: from... it can be seen...).

The report must not only contain all relevant information and conclusions but must be **clearly written**. A rough draft helps to structure the report and to avoid a loss of important information. The rough draft is the starting point to generate a concise and readable document.

Graphical presentation of data

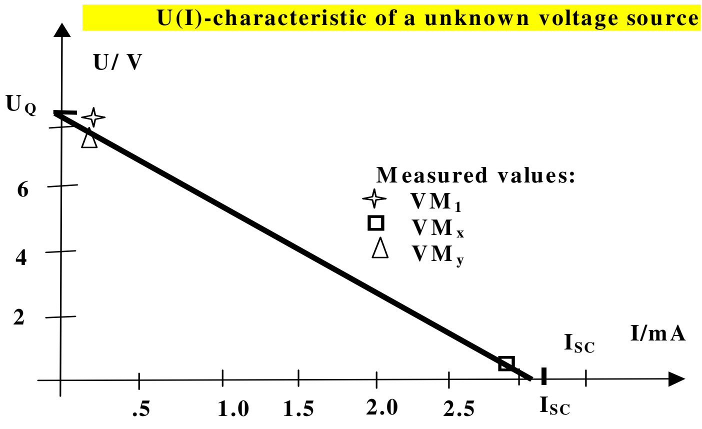
Diagrams are an efficient, valuable and convenient way of analysing data. Graphs are used to help **visualize** analytic expressions, to **interpolate data** and to discuss errors.

Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

Graphs should always have a **title**, the **date** the data was taken, and adequately **labelled** and **scaled axes**. All measured values are marked and are visible despite an interpolation line.

Always use grid paper with given lab scales:

1 unit =1, 2, 5 ,10, … per square



An effective way to detect experimental errors is to plot the **theoretical data before the experiment is performed**. Then, as the experiment is performed, the actual data can be compared with the predicted data.

Voltmeter	Meas. range	Voltage U_0/V	Ammeter	Current I/mA
VM_2	0..1.0	0.65	AM_3	3.75
VM_2	1..2.0	1.86	AM_3	5.93

Table Exercise: U(I)- Characteristic of a Source

Note:

Data is plotted at the same time when it is taken, not afterwards.

In many instances, the experiment can be stopped, and examined as soon as any major discrepancies between the predicted and actual data are noted. In addition, any unexpected data points can be rechecked before the experiment is dismantled. Once the data is plotted, a smooth curve needs to be drawn that best fits the data. When the data appears to be in a straight line the best fit is usually a line.

Systematic set up of circuits

Note:

Before you are connecting the elements of a circuit plus instruments a complete circuit diagram including a list of all instruments **must be presented** to the staff!
At any instant of the experiment the wiring diagram must be an actual one !

Procedure

In order to avoid mistakes due to misconnecting elements when setting up a circuit follow these rules:

- Use **different coloured wires** to indicate the voltage polarity at the connecting terminals, always red for +, blue for ground and e.g. green for the connection of instruments.
- Always make a clear circuit diagram and layout plan, and then arrange all instruments and elements in accordance with this plan.
- Connect the devices mesh by mesh (one section at a time) beginning with the source terminal (+) then moving clockwise element by element of one dedicated branch until you reach the ground terminal (-). Then continue with the next mesh.