

BIPM Capacity Building & Knowledge Transfer Programme
2018 BIPM - TÜBİTAK UME Project Placement

REPORT

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| Project Name | Electrical Power Measurements |
| Description | Calibration of power meters using a power standard |
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Motivation & Introduction

Improving the methods of metrological support is a priority area for the development of fundamental research in the field of energy. The main goal of this project was to gain experience in the calibration methods used in the field of energy and power metrology and also in the calculation of their uncertainty budgets. The knowledge obtained will be useful, first of all, in carrying out international comparisons of the standard for the unit of electric power, as well as in the transfer of the dimensional unit to lower reference measuring means. The experience gained in the project will allow the improvement of the quality of services for the calibration and verification of the power and energy meters used in Belarus and for measuring instruments coming from other countries.

Research

In the practical exercises, the Fluke 6105 power meter was calibrated. When calibrating the active, reactive and apparent power with a current strength of up to 20 A, the reference power is selected as the reference, and more than 20A apply standard power and transformer together with the Elma measuring system. When calibrating the Flicker and harmonic the NI USS 4431 was selected as the reference for the AC components.

The calibration of three phase power meter Fluke 6105 is performed by comparing the active power, reactive power and apparent power measurement functions of the device with the AC Power Measurement Standard. The AC Power Measurement Standard is used as a reference wattmeter for precise measurements (Fig 1).

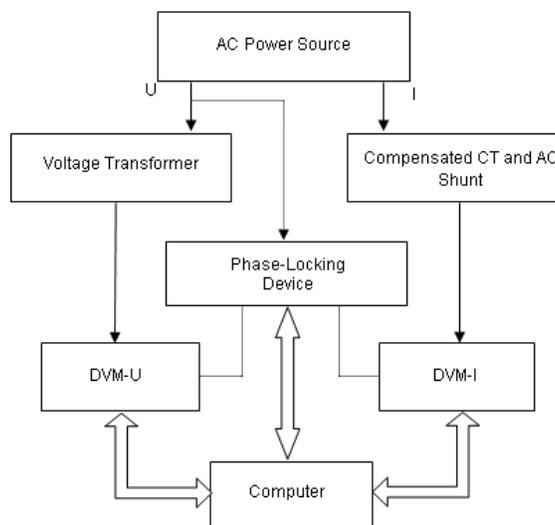


Figure 1. AC Power Measurement System

Especially the performance of this calibration is that direct measurements of power on AC Power Measurement Standard are carried out up to a current of 5A, with a current intensity of **5A to 20** measurements, also performed on AC Power Measurement Standard, but with the use of an additional shunt, which increases the accuracy of measurements in comparison with the use of the Elma measuring system. The wiring diagram is shown in Figure 2.

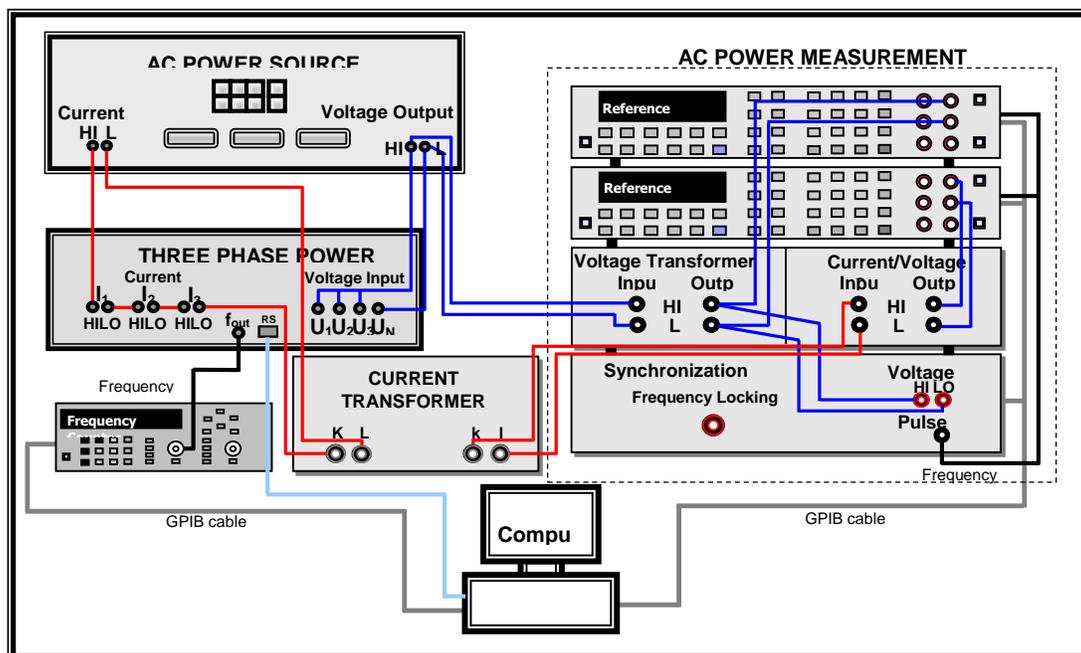


Figure 2. AC Power Measurement System with the transformer

Also, in order to eliminate operator error and to exclude instrumental errors, the measurements were performed automatically using specialized software. This in turn made it possible to speed up the process of calibration and analysis of the measurement results.

Conclusions and Future Work

During this training I attended lectures that included: basic metrological concepts and definitions, the main definitions used in practice of power and energy measurements, the theoretical basis for measuring power in single-phase and three-phase alternating current circuits, the theoretical basis for measuring the dose of flicker and harmonic AC components, calibration of the analyzers of electric energy and power quality; estimation, budget and calculation of uncertainties in the measurement of electrical power, flicker and harmonics of alternating current.

The main part of the practical training concerned gaining experience with the use of the electric power standard. With the help of this equipment, calibrations were performed on measuring instruments such as the Fluke 6105 electric power calibrator, the three-phase comparator Zera 3003 and others. In the course of the training, errors were identified in the uncertainty calculations that were previously used and recommendations were given for their elimination.

With regard to the application of the acquired skills, next year, as part of the modernization of the standard of a unit of electrical energy, the laboratory at BelGIM will be refitted. I expect to utilize the knowledge and experience I have gained through this project in this effort.

Acknowledgements

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