BIPM Capacity Building & Knowledge Transfer Programme

2019 BIPM - TÜBİTAK UME Project Placement

REPORT

Project Name	Strengthening of IMBIH capacities with development of a power and power quality (PQ) calibration system
Description	Development of a power and power quality calibration system based on existing equipment at IMBIH, and specification of needed additional equipment
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Motivation & Introduction

Precise power measurement is very important in the area of energy maintenance to reduce power losses, while maintaining their traceability. Therefore, the capabilities of power testing and calibration have grown and the demands from IMBIH to provide such services have increased. Currently, in Bosnia and Herzegovina there are fourteen distribution companies which use power meters for internal verification of power meters installed in the distribution and transmission grid. Traceability for these instruments is obtained from other NMIs, which is rather costly. With the increase in power generation from renewable sources, precise power quality measurements are required, which has led to greater demand for a laboratory with the capability to perform calibration of such devices. Currently, these devices are mostly only calibrated at the moment of procurement due to the lack of necessary infrastructure for their calibration in Bosnia and Herzegovina.

The main goal of this project was to gain knowledge on how to build and implement such a system using both existing equipment and additional equipment that is planned to be procured in the near future. The establishment of such a system would provide B&H with its first laboratory to offer traceability for power and power quality measurements, which in turn would support the ever-growing electrical energy industry.

Research

The current plan at IMBIH is to develop primary and secondary level calibration systems. The primary standard is the digital sampling wattmeter (DSWM), which is made out of two digital multimeters 3458A, voltage dividers and current shunts. The secondary standard is

a reference wattmeter. For the purpose of this research, a secondary standard was calibrated using the primary standard. The Power and Energy Laboratory at TUBITAK UME has two working standards at secondary level – an Applied Precision RS2x30 and a ZERA COM3003. Both were calibrated using DSWM. For the power source, a Fluke 6105A was used. Power is generated, and active, reactive and apparent power are measured by DSWM and the device under test (DUT). Measurements from the DUT are compared to the measurements of the DSWM. Picture of such setup is shown in the picture below.

Figure 1. Calibration of ZERA COM3003 using DSWM

Measurements are software-controlled. Since DSWM samples the measured signal, software must be used. The digitizing mode of multimeter 3458A does not provide us with a result on the screen of the instrument, hence using software cannot be avoided. The signal is sampled and then processed using Fast Fourier Transform. This brings us to the second part of this project, which is how DSWM works. A block diagram of DSWM is shown in figure 2.

Power is generated from the power source, current and voltage signal separately. The voltage signal goes to the resistive voltage divider because measurement of voltage using multimeter 3458A is the most accurate in the ranges of 1V and 10V. The current signal goes to the current shunt. Current is measured as voltage, since voltage measurement is more accurate than current measurement, again also in the ranges of either 1V or 10V. Here, both were measured at a voltage level of 0.8V. Measurements of both multimeters need to be synchronized, sampling of both signals has to happen at the exact same moment. Hence, a synchronization unit is used. In the Power and Energy Laboratory at TUBITAK UME, a phase locking device is used. However, in the future development of this system at IMBIH, an arbitrary waveform generator will be used. This is primarily because this device exists in the IMBIH laboratory, which means no additional equipment will have to be procured for synchronization.

Also, through the EMPIR project TracePQM, a software for these kind of measurements is under development. During the study at UME, some time was spent on getting to know this software so it can be used in the future system at IMBIH.

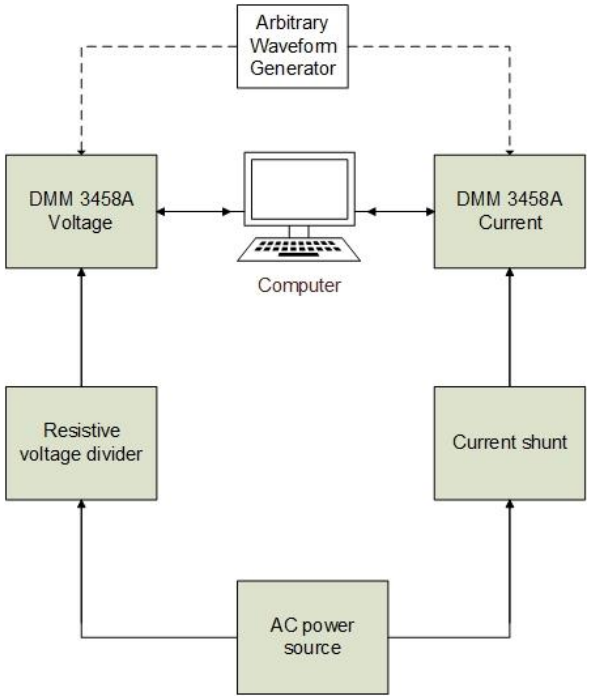

Figure 2. Block diagram of DSWM

Conclusions and Future Work

As a result of this project placement, expertise needed to establish the system for calibration of power and power quality meters was obtained. This will expedite the development of such a system at IMBIH, which will greatly increase laboratory capacities and also provide the existing industry with a much needed infrastructure. In the future, this can also mean further development of the industry since their needs will be met by IMBIH. It is planned to continue research on this system, as there is much which can be contributed within the field of power and power quality measurements.

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