

## CONTROL SYSTEM DESIGN OF A SINGLE PHASED POWER RECEIVER FOR THE COMPENSATING-SYMMETRIZING PROCESS

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### ABSTRACT

The single-phased power receivers, supplied to the industrial frequency, represent very inductive loads. These are connected to the three-phased network through the Steinmetz connection symmetrizing devices. Considering an experimental model which is reproducing in a small scale the real device, we have realized the designing of the control system, connected to the output interface of the DAQ, which is able to generate the signals for the execution elements from the experimental model power equipment.

**Keywords:** Virtual instrumentation, compensating, symmetrizing

### 1. CONTROL CIRCUIT

The designed circuit by the authors is presented in figure 1.

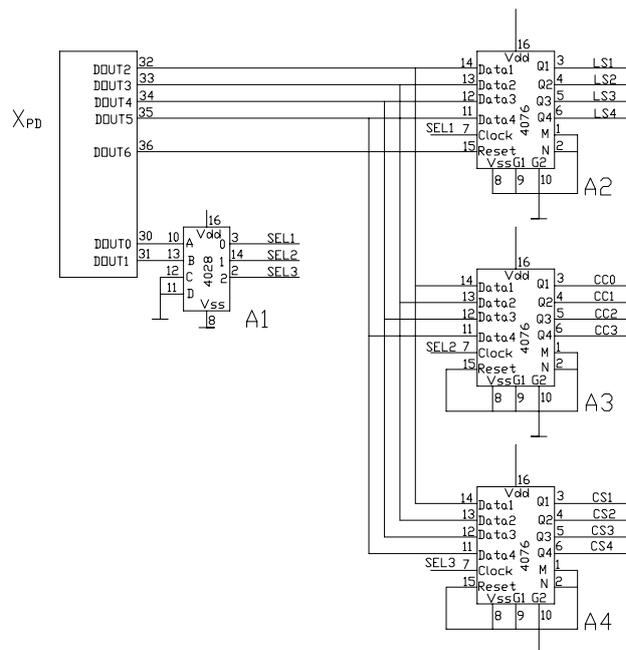


Figure 1. The steps selecting circuit of the compensating-symmetrizing reactive components

The circuit for the compensating-symmetrizing process control is selecting the required steps in order to reach the optimum working run according to the previous scheme.

This circuit has been designed to control the compensating-symmetrizing process for a high power single phase receiver using a Steinmetz scheme with its reactive components divided in 12 steps: 4 steps for the symmetrizing inductance (LS1÷LS4), 4 steps for the symmetrizing capacitance (CS1÷CS4) and 4 steps for the compensating capacitance (CC0÷CC3), CC0 being the fixed step. All these steps are selected by means of the ports A2÷A4. These three ports are enabled in accordance with the user will through the A1 device. X<sub>PD</sub> is representing the output port concentrating the digital outputs of the DAQ card.

The control circuit is connected to the output of the DAQ card and is generating the control signals for the electric power equipment of the experimental model.

## 2. CONTROL OF THE COMPENSATING-SYMMETRIZING PROCESS

The authors have used the LabVIEW software in order to fulfill the proposed aim: the control of the compensating-symmetrizing process.

The Virtual Instrument Caut.VI, realised for the mentioned purpose accomplishment, is included in the complex structure of the entire program that monitorizes and control the compensating – symmetrizing process to the coreless induction furnaces. All the virtual instruments (VI) realized are connected in accordance with the organigram presented in the figure 2.

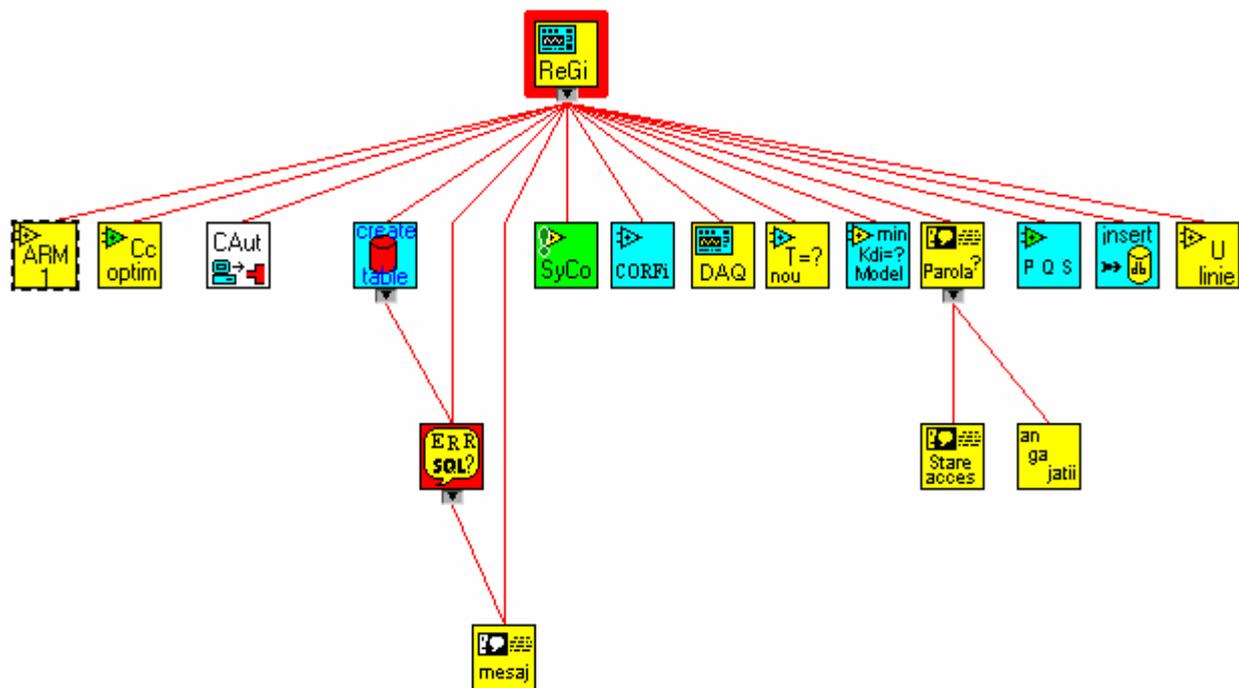


Figure 2. The hierarchy of the entire program

The CAut.VI, presented in this paper, is initiated after the first data acquisition and the determination of the optimum combinations of the reactive components steps (CC, LS and CS). Then, after each data acquisition, the VI is generating the updated combination of the reactive components steps in order to obtain the optimum control process.

The program has the following steps:

1. Initialization – the first acquisition is realized;
2. The second acquisition takes place;
3. The current combination, resulted after the calculus, named as “Trepte Cda Crt” in figure 3 and 4, is compared with the combination “Trepte Cda Ante” given by the anterior acquisition. These figures are presenting the main principle of the VI, respectively the VI icon and connector.

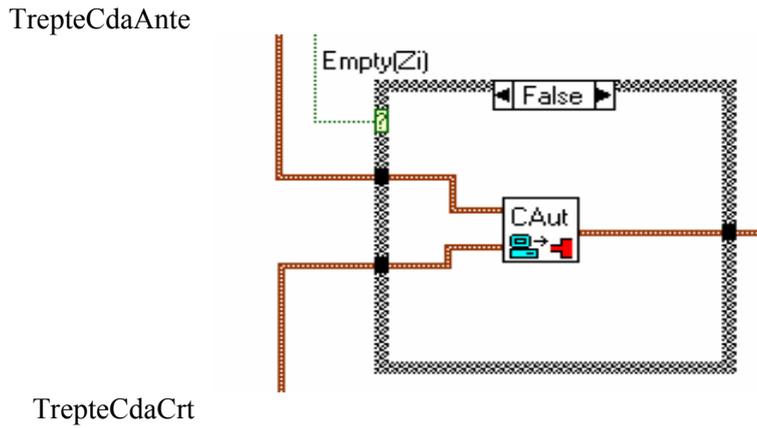


Figure 3. Principle of the CAut.VI

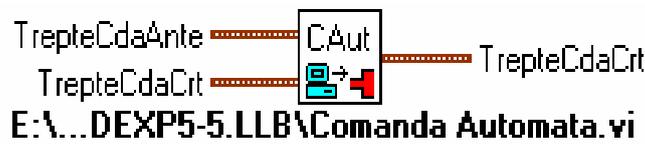


Figure 4. The VI icon and connector

The comparisons between the current and anterior components steps resulted after two consecutive acquisitions can be observed in the VI bloc diagram, presented in figure 5. As it can be seen in this exemple for all three batteries of the reactive components the current combinations are enabled, because "TrepteCdaAnte" is different from "TrepteCdaCrt", so we are in the "True" logical state of the "if" instructions.

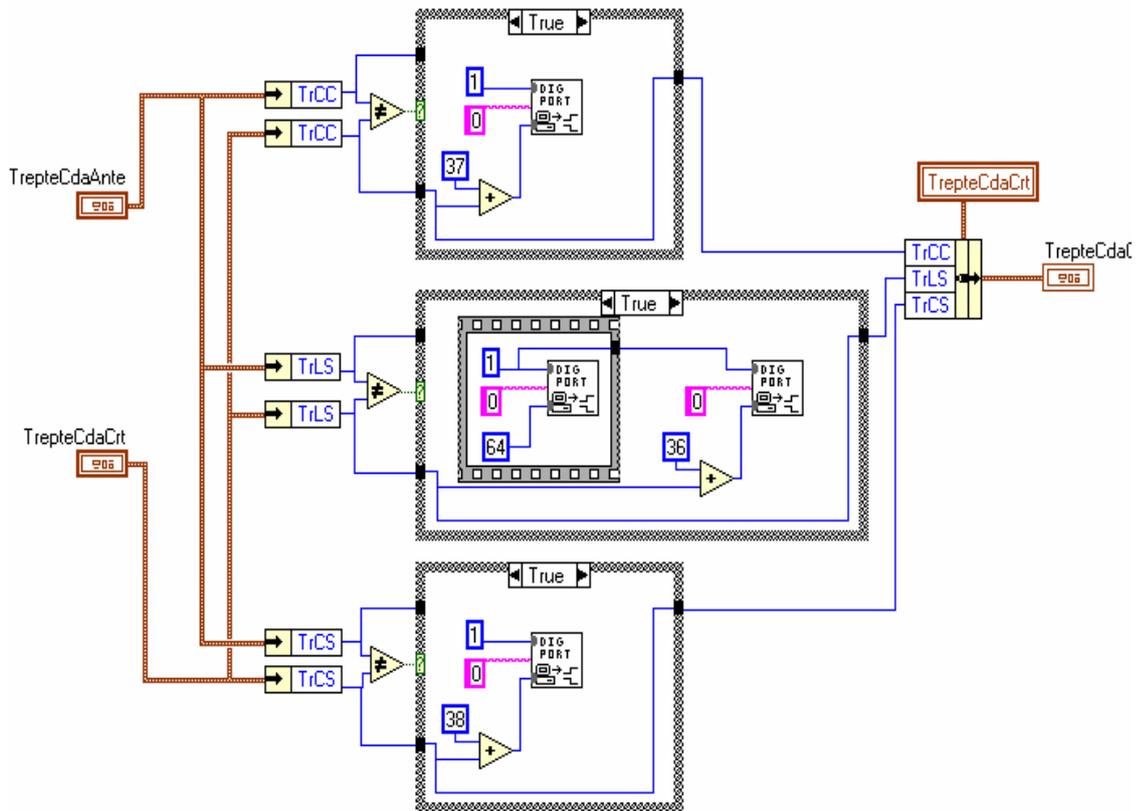


Figure 5. Bloc Diagram of the Caut.VI – first variant

4. If there are not differences between the two combinations, the existent combination is maintained without any other command. These situation is presented in the figure 6 as the second variant of the VI bloc diagram for the TrCC steps of the compensating capacitors battery; the “if” instruction has the logical state "false" in this case.

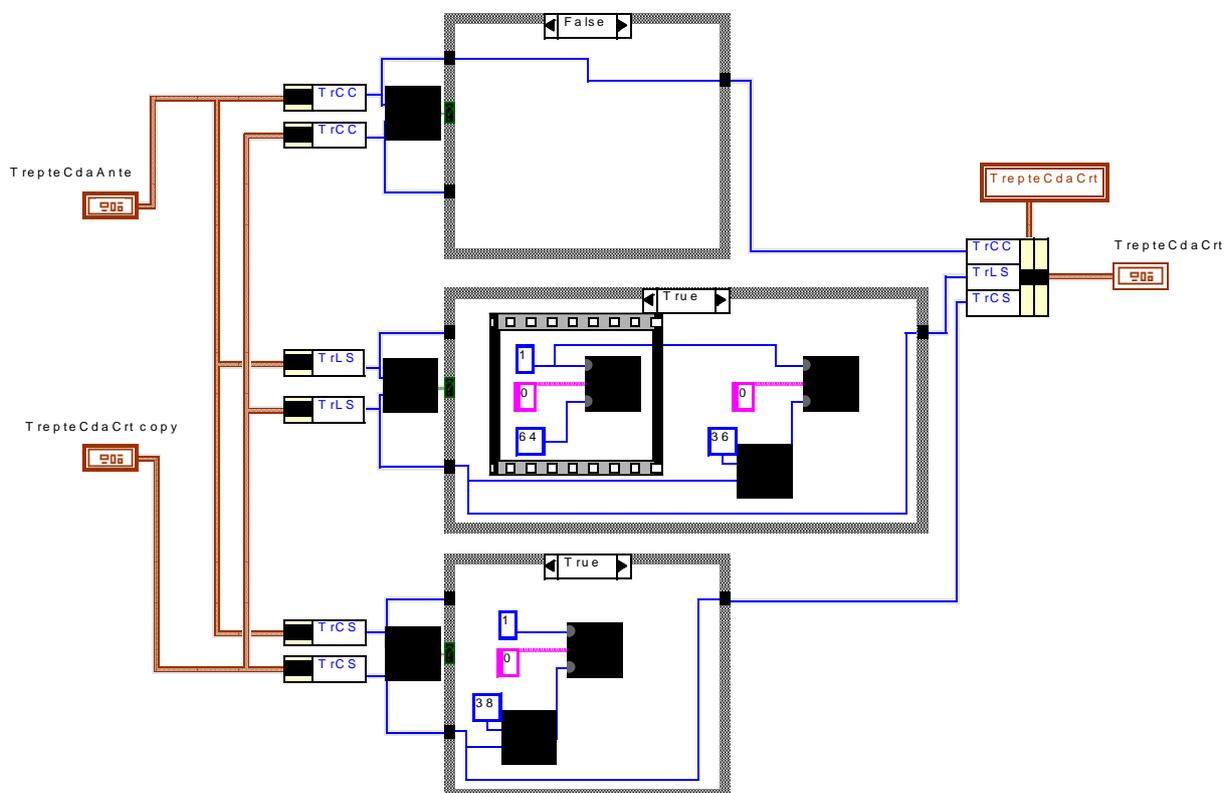


Figure 6. Bloc Diagram of the Caut.VI – second variant

5. Whenever a modification occurs the switching between the anterior steps combination and the current one is commanded. For the next data acquisition, so for the next comparison the “current combination” will become as the “anterior combination”.

### 3. CONCLUSIONS

The realized experimental model is representing an adequate and modern workbench for students and researchers in order to study the electrical power quality, the control of different processes using the data acquisition and the virtual instrumentation.

Using the proposed algorithm one or more furnaces can be successfully controlled depending on the number of the data acquisition cards and transducers.

### 4 REFERENCES

- [1] Cottet,F., Ciobanu,O. Bazele programării în LabVIEW. Editura Matrix Rom, București 1998.
- [2] Maier,V. și Pavel, S. - Automatic Control of the compensating-symmetrizing process at coreless induction furnaces. Proceedings of the International Symposium of Automations THETA, AT&T, may 1996, Cluj-Napoca, Romania.
- [3] National Instruments. LabVIEW advanced course manual.