ELECTRONIC CONTACTOR WITH TIRISTORS FOR AN OPTIMAL CONNECTION OF A THREE PHASE TRANSFORMER TO STAR NET THE SECOND BEING OPEN

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***Abstract* – This work paper describe an electronic contactor which realize an idle connection of three-phase transformer to the net in an optimal way preventing the over currents.**

Keywords: *electronic contactor, tiristors, transformer, optimal connection.*

1. INTRODUCTION

The connection of the transformers and autotransformers to the net when the secondary is open represents a real problem and many times the protection device noticing strong currents intervenes by disconnecting them.
To avoid disconnections fuses with delayed action great answering time are used. This may lead to a lack of protection of the device with a transformer or auto transformer. Other dangers are excess load that need disconnection in minimal time. The use of the contactor suggested by the authors (see Fig.1) allows the use of high speed fuses together with all their advantages.

2. THE BLOCK DIAGRAM OF THE ELECTRONIC CONTACTOR

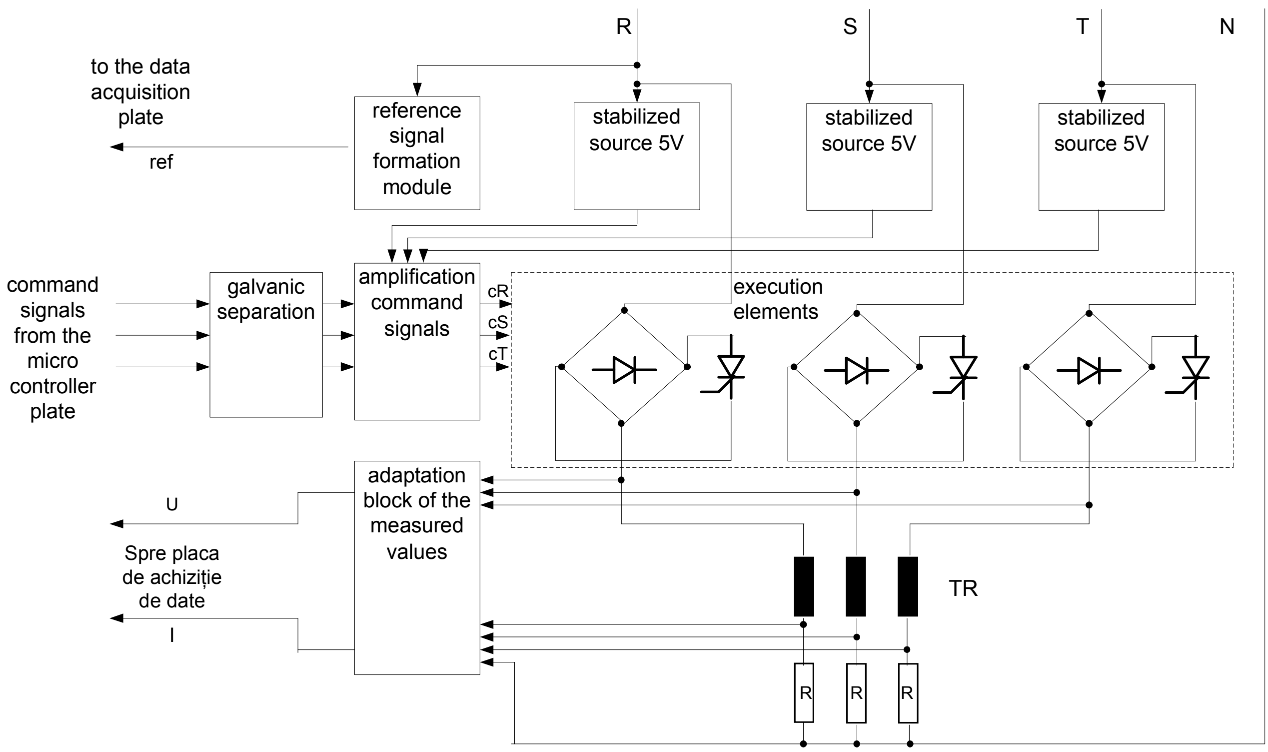

Fig.1. The block diagram of the electronic contactor

3. THE FUNCTIONAL ROLE OF THE BLOCK DIAGRAM COMPONENTS

The signals received from the block with a micro controller for separate command of each element of commutation from the three phases of supply of the transformer, are galvanic separated in order to protect the command block against increased voltages. Then they are amplified in the amplification module and applied on the thyristors grid.
With the help of the “adaptation block of the measured values” the output voltages from the electronic contactor, as well as the currents in the transformer windings are adequately adapted to their interpretation by the data acquisition plate. The reference signal formation module takes over phase R and interprets it in order to transmit it to the data acquisition plate. The sources supply separately in stabilized continuous current each and every amplifier aiming the commands precision of the execution elements without being influenced in any way by the other phases.

4. THE RESULTS OF THE ELECTRONIC CONTACTOR APPLICATION

Connecting the transformer to the net for aleatory moments the obtained recordings (Fig.2) have shown the followings:

- the shape of the connected phase voltage and the connected current phase confirms the theory according to which the current through the specific winding is appreciatively by 90º behind the voltage;
- in the other two windings the induced voltages are in antiphase with the connected phase voltage; the shorter their amplitude, the greater the length of the corresponding magnetic circuit
- after the connection of the second phase in the transformer's winding remained unconnected , the induced phase is in phase opposition with sum total voltage of the two phases already connected; this leads to a slight switch of the thyristor when it receives a command foe connection of the third phase;

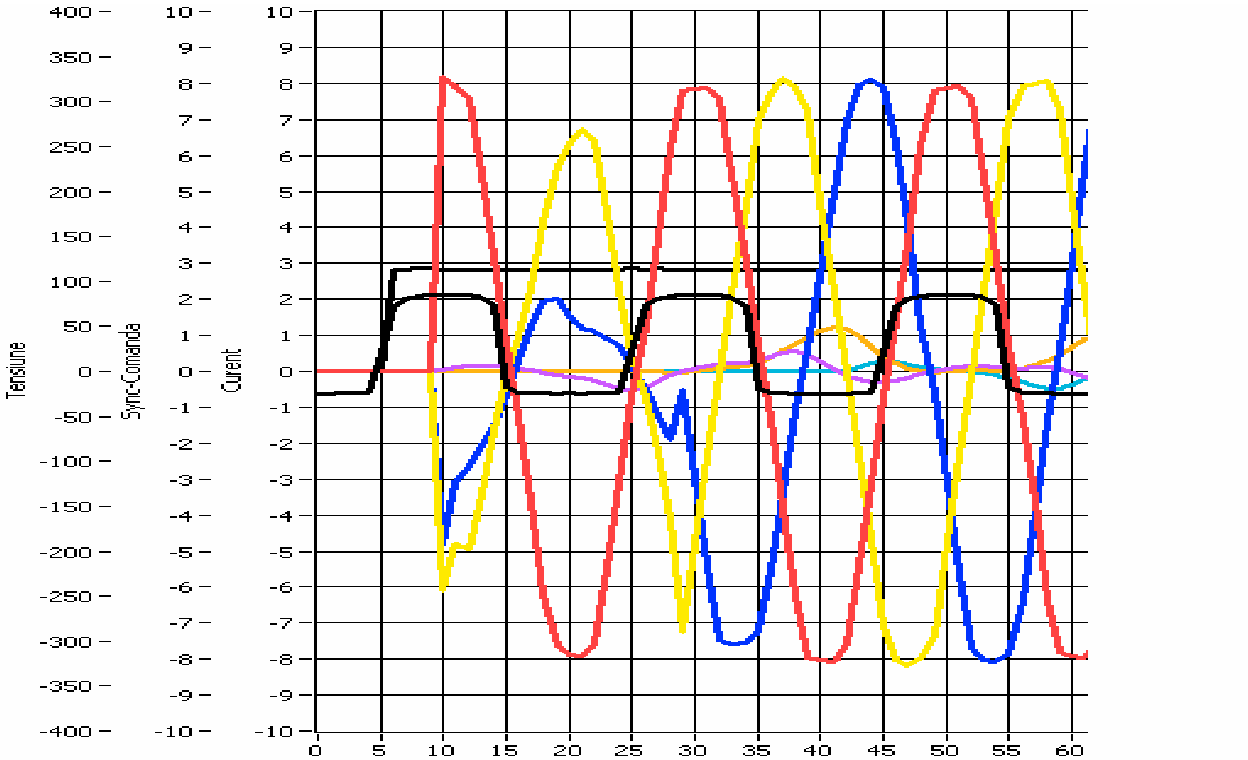

Fig.2 The wave shapes of the terminal voltages and of the currents through the transformer's windings connected through the electronic contactor

- it is clearly points out the non-sinusoidal variation of the idle currents due to the non-linearity magnetic characteristics of the ferromagnetic core and the hysteresis cycle around the origin of the axes.

5. CONCLUSIONS

The analysis of the presented wave shapes shows that the presence of the induced voltages as a result of the successively controlled connections of the phases does not represent a problem for the used commutation elements (mainly that of the thyristors).

The phase voltage irregularity for the third phase when the second phase is connected is not a problem and it is going to be applied to the thyristor later when it receives the command for the respective thyristor, the wave shape variation being unnoticeable in the moment of connection.

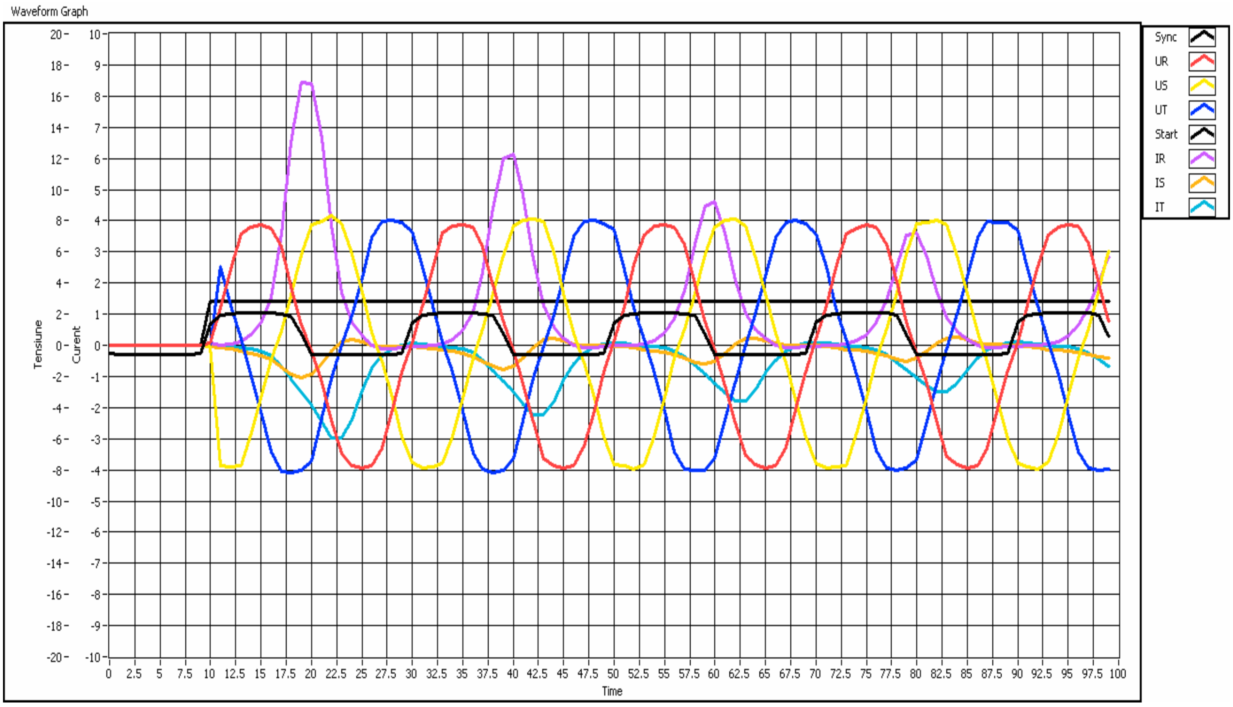

Fig.3. The wave shapes of the terminal voltages and of the currents through the transformer's windings connected through the electronic contactor, when the connection is establish in an improper moment

References

[1] Piroi, I. , *Maşini electrice*, Ed. Didactică şi Pedagogică, Bucureşti, 2004.

[2] F. Ionescu, *Electronica de putere*, Editura Tehnica, Bucuresti, 1998