

NUMERICAL PROTECTION SYSTEM FOR AN ELECTRICAL TRANSFORMER

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Abstract: In this paper will be presented a possibility for realization of numerical protection system, for an transformer. In fact, this system is realized from any modules: an module for measured of current, an module for measured of tension, an data acquisition and processing system realized with microcontroller and communication module.

Keywords: numerical protection, acquisition data system, microcontroller, conversion

1. INTRODUCTION

In this paper will be presented a numerical protection system for an electrical transformer with two coilings, system made of two protection types: maximal of current with a locking of minimal tension, and differential protection. The principle scheme of protection is presented in figure 1, and block scheme is presented in fig 2.

Acquisition data system to get energetically parameters needed for the function of the protection system, so:

- the tension U , from transformer TT , needed for realized of the maximal of current with a blocking of minimal tension;
- current I_1 from TC_1 transformer, needed for the realized maximal current but also for the achievement differential protection;
- current I_2 from TC_2 transformer, needed for differential protection.

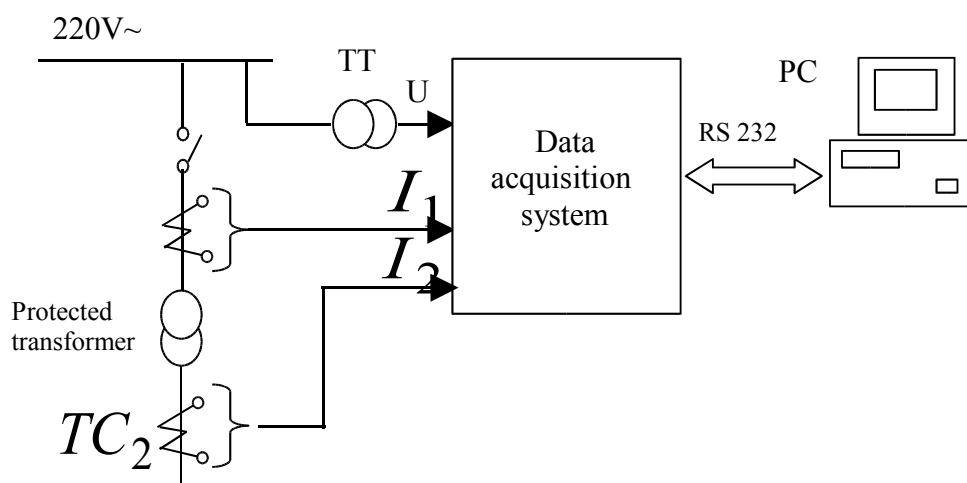


Fig. 1. The principle scheme of protection

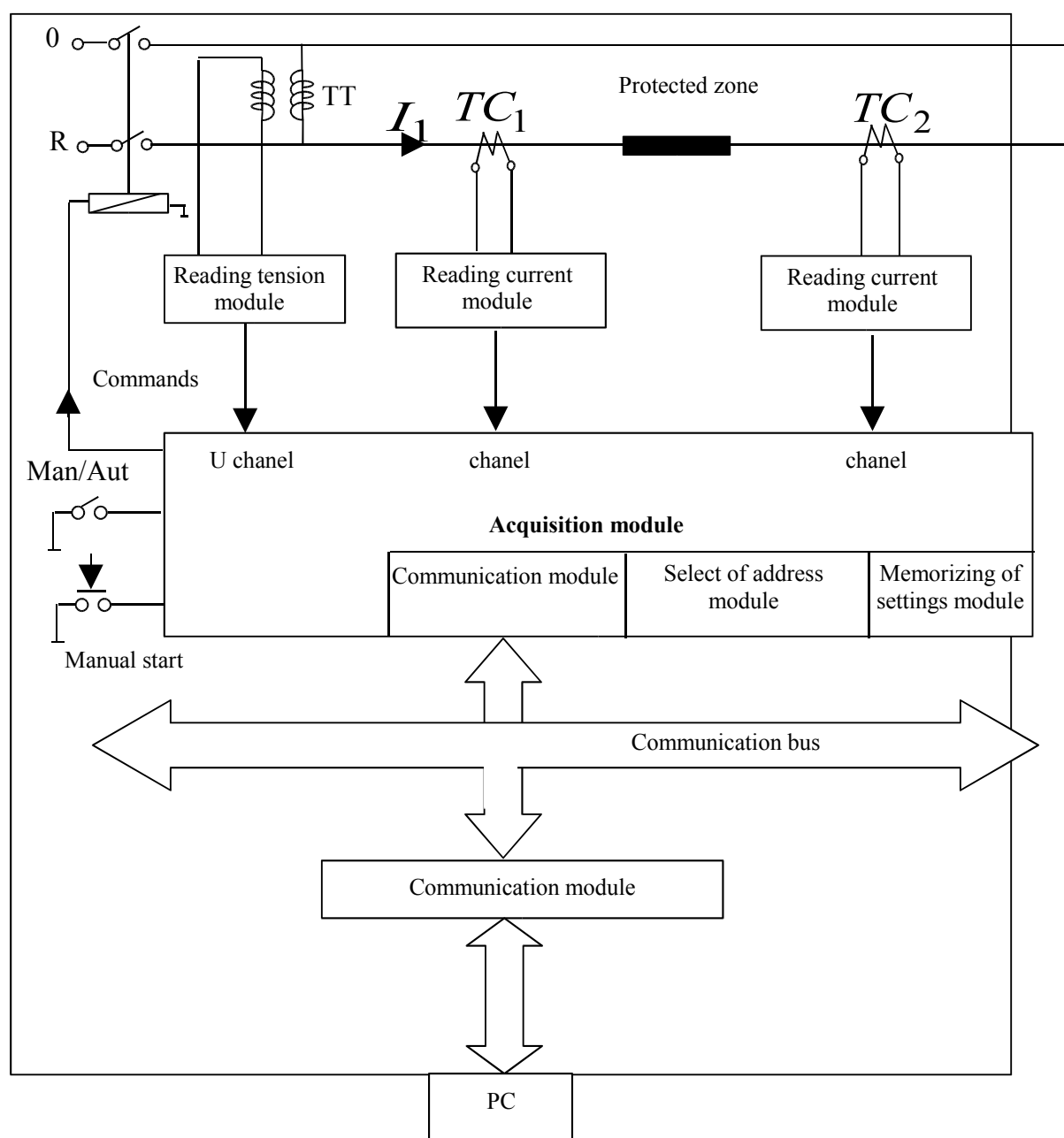


Fig.2. Block scheme of numerical protection system

2. THE REALIZED OF THE NUMERICAL PROTECTION SYSTEM

In figure 3 is presented the scheme of reading tension/current. Signal's adaptor (adjustable) assures the conversion current – tension or tension – tension, depending of the input *mărime* and the values of the resistors. Also, this adaptor increases the current ability of reading module. *Redresorul monoalternanță* together the peak detector allows the obtained tension at the output, that has a value proportional with the *efectivă* value of input signal, by adjusting *amplificării circuitului redresor*. The *amplificării* adjusting is necessary for according the output signal from reading module with inputs of acquisition module.

In figure 4 is presented data acquisition module. This is development around the AT 89 S 52 microcontroller,

which has a function to command another circuits, to achievement the communication cu central dispatcher and to elaborate decisions in order achievement protection's functioning.

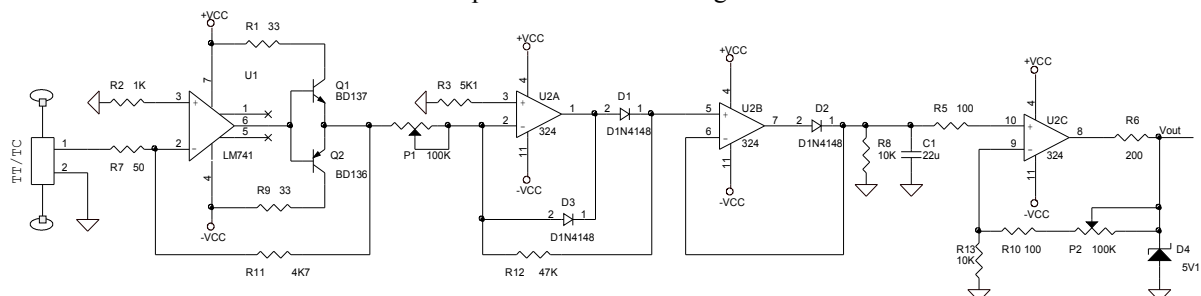


Fig. 3. Scheme of reading tension/current

Analogical - numerical conversion is achievement with ADS7841 circuit, which is an 12 bits analogical – numerical converter with 4 input channels. Also, in the acquisition module structure are:

- memorizing of settings module, for keeping the different prescribed values, in disappeared supply tension case;
- setting address module, for physical ascribing a only address for each acquisition module for recognizing by informatical application's program;
- communication module, which assures the communication with central dispatcher (PC), and also, optical isolation of data bus.

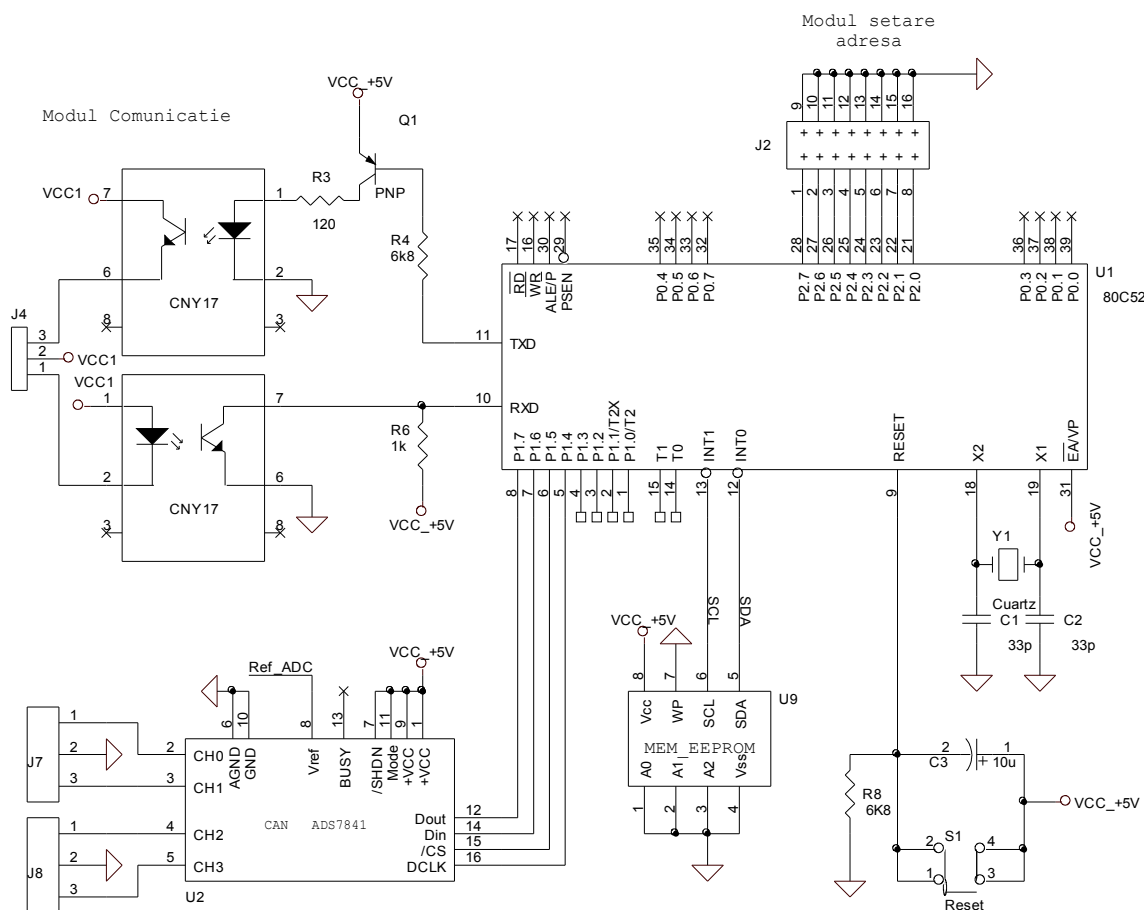


Fig. 4. The scheme of data acquisition module

3. THE FUNCTIONING OF THE APPLICATION

The logical scheme for the functioning of protection system is presented in figure no.5

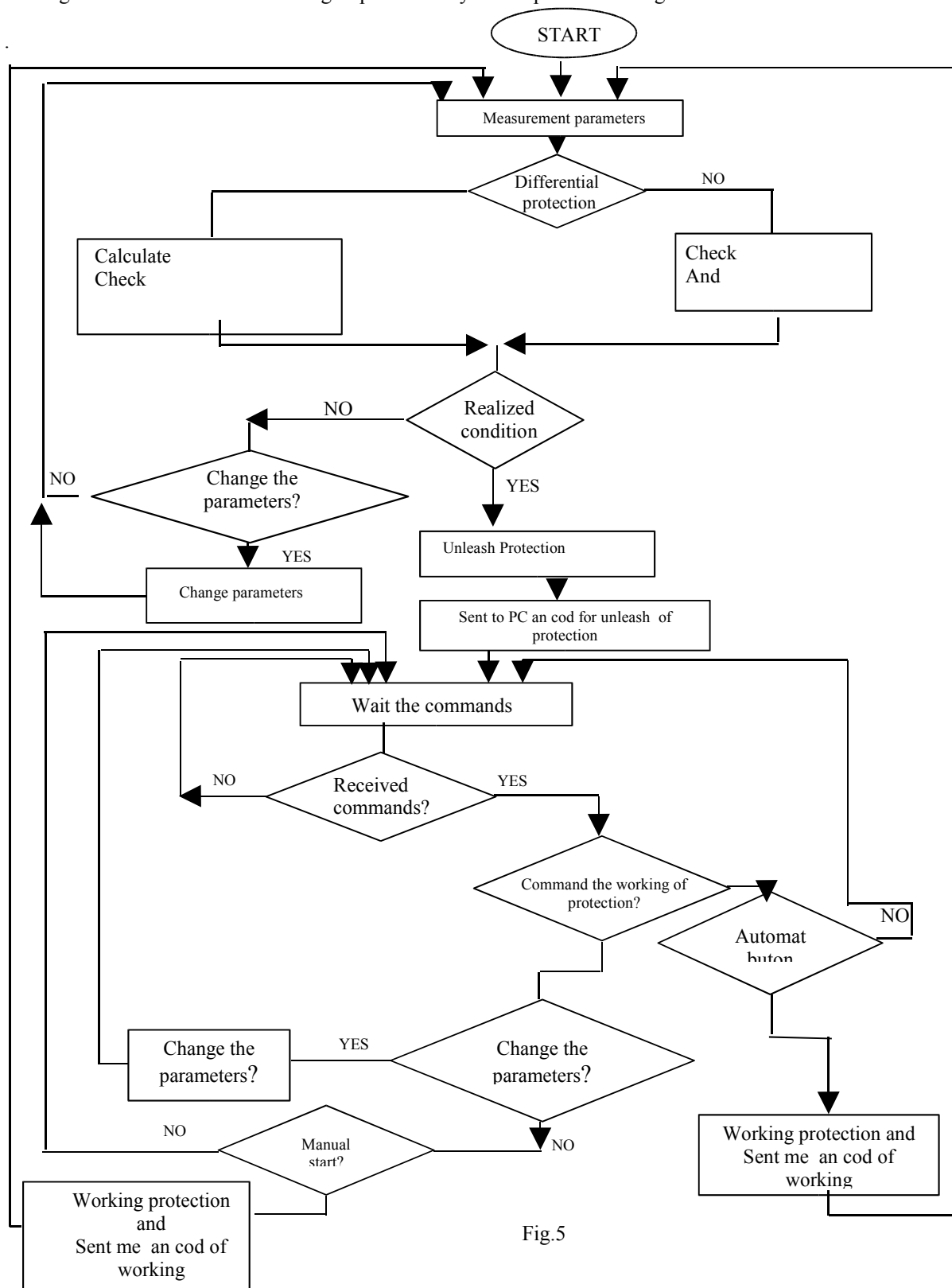


Fig.5

The conversion module RS232 is converting the signal received from PC, having logical levels ± 12 V, in logical signals with TTL $(0 \div 5)$ V, needed for the communication with the ATMEL 89C 52. So, due to this module the microcontroller ATMEL 89C 52 receives from the PC the imposed reference values, for the current, but also for the tension, and compares them with the measured values of the current and tension.

The measured tension and current by the transformers of measure of current and tension also, are converted in numerical signals by analogical - numerical conversion circuits, realized with the TLC 1549 integrators, commanded by the microcontroller.

3.1. Functioning as maximal of current with a locking of minimal tension

The protection system working when $I_{measured} > I_{prescribed}$ and $U_{measured} < U_{prescribed}$ and commands the opening of the interrupter I, interrupting the supply circuit of protected transformer. This circuit remains interrupt until the improving of the default which has made the working of the protection. After that, the protection system passes in stand-by, and the alimentation circuit of the protected transformer will be put again under tension by a command made by the computer, or by a local command of starting.

In the case of local command are kept the values prescribed for the current and tension, before the unleash of the protection, and in the case of PC command the restart of the protection may be made with another prescribed values for tension and current

3.2. Functioning as differential protection

In the protected circuit are assembling the two transducers of current for measuring the currents I_1 and I_2 . The output of those transducers is connecting at the reading of current module, which transforms the alternative current signal in continuous tension signal. The two continuous tensions are converting in numerical signals by the ADS7841 analogical-numerical converter, commanded by the microcontroller.

The microcontroller is calculating the difference in absolute value between the two currents and compares the result with the value received from the computer corresponding to the admitted difference between those two currents. If the result sent by the microcontroller is bigger than the received value from the computer, the unleash of the protection will be commanded. Next, the microcontroller is waiting for commends from the PC and local commands.

As local command is the manual unleash of the protection. From PC can be command working of the protection, command witch is accepted in automat working mod only. Also, can be change the maximal value of difference between those two currents. The microcontroller sent to PC the information about protection state, in the working case but also in the unleash case of this. The acquisition module communicates with the computer by communication module, witch realized and galvanized isolation, numerical system realizations however adaptation of necessary level.

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