INDUCTION MOTOR PROTECTION DEVICE

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Modern enterprises successful operation depends on reliability of working machines electric drive. Most often, the electric drive is an induction motor, which has a simple structure and is a reliable electric machine. However, there is a relatively high percentage of induction motors failure due to specific conditions and modes of operation, which were not taken into account in the design [1]. Failure of electric motors leads to significant financial costs. Standard electric motors protection devices do not allow to carry out continuous control of operation therefore electronic diagnosing devices development of electric motors operating modes is actual.

The protection device of induction motors which scheme is shown in fig. 1. The motor protection device provides continuous condition monitoring

and reliable protection of supply voltage asymmetry, overload, overheating and jamming. The device works according to the diagnostic algorithm, which is considered in [2].

One of power grids features is frequent emergency situations associated with the absence of one or two phases. Phase breakage protection consists of capacitors C1-C3, rectifier VD1 and voltage filter R1C4. The latter provides voltage smoothing, and is also a delay element in operation during short-term voltage fluctuations. Potentiometer R2 sets the threshold. The voltage limited by the zener diode VD2 is supplied to the ADC input of the microcontroller DD1 through the key DA1.1. The key is controlled by logic HIGH (1) from the PB1 out.

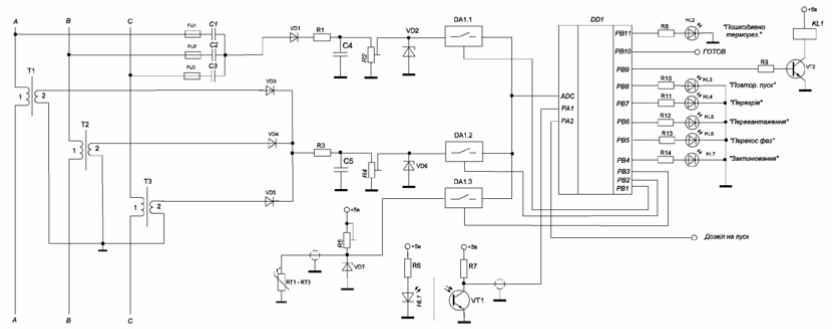

Fig.1. Protection device circuit diagram

One of main negative factors is prolonged excess of rated motor current. The role of primary phase currents converter is performed by matching transformers T1-T3. The voltage from secondary windings is proportional to corresponding phase load. Only the phase with highest current consumption is connected to the input of the microcontroller. The signal is provided by the switching key DA1.2.

Among factors that lead to the induction motors failure, the stator windings overheating plays a significant role. The device includes thermistors

RT1… RT3, located in the phases of the stator winding. The voltage drop across them corresponds to windings temperature. Potentiometer R5 allows to set the required sensitivity threshold. The temperature converter signal comes through the key DA1.3 to ADC input of microcontroller DD1.

Rotor speed checkout allows to turn off the motor in a timely manner, if it could not accelerate for some time. This mode working through a long time is unacceptable. The rotor speed is controlled by an IR-sensor consisting of LED HL1 and phototransistor VT1. Pulses from sensor are fed to the input PA1 of microcontroller DD1. The pulse frequency will be greater the faster the rotor will rotate.

LEDs HL4… HL7 are installed to inform the staff about cause of induction motor emergency stop. LED HL3 confirms the successful motor restart after an emergency shutdown. LED HL2 is intended for thermistors control. The motor is operated by relay KL1.

References:

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