PRINCIPLE OF RELAY DESIGN AND OPERATION

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Abstract. *The main issue is that the protective devices used in the protection of electric motors should be modern, based on digital technologies, work with a high level of accuracy and have high sensitivity. It describes the use of a microprocessor relay. possible major damage can be avoided.*

Key words: *Relay, current transformer, Protection sensitivity, protection limit, protection speed.*

The relay provides protection and control of the electric motor through a switch, contactor switch or other devices adapted for automatic operation and capable of interrupting short-circuit currents that cause the breaking of protected contacts. The output circuit of the relay is a contact connected in series with the coil of the contactor.

The relay does not require an operational source voltage. Control voltage is also supply voltage. Functionally, the motor protection relay consists of two blocks:

- power unit;
- control and indicator unit.

All relay elements are installed inside the housing. The front panel contains: a four-digit LED indicator, three buttons for setting the relay operation mode, eight LED indicators for alarm status, as well as a two-color LED indicator for the output relay status.

Switching order

The relay is manufactured fully configured and does not require additional configuration during operation. Regular maintenance is not required when the relay is used in accordance with the specifications and this manual during the service life, including continuous operation. Before installing the relay in the facility, as well as after long-term storage of the relay as part of the equipment, it is recommended to test its operation in the settings in which the relay is expected to operate. The motor protection relay is not a measuring device, therefore, the setting and monitoring of operating currents and voltages must be carried out using ammeters and voltmeters of the required accuracy class. When the source voltage is applied to terminals 3...6, the output of the relay is de-energized and its contacts (terminals 2-4) are in the initial (open) position.

To close the relay contacts, the following conditions must be observed:

- compliance of the supply voltage with the settings (it should be in the voltage range Umax ÷ Umin);

- The insulation resistance of the electric motor is higher than the installation limit;

- direct phase sequence;

- lack of current in measuring circuits (control of contactor contact adhesion).

Checking the correctness of the phase sequence is carried out only when the relay is turned on. When these conditions are met, after approximately (1-2) seconds, the relay contacts close and the LED indicator K lights up green.

When the relay is connected to the network, the message U _ Error may appear on the indicator panel. In this case, it is necessary to check the correctness of all programmed settings in the relay (in accordance with clause 4.1.2 of this OM). Any relay settings need to be reprogrammed if they were programmed correctly.

Relay operation before starting the engine

After the output contacts of the relay (terminals 2-4) are closed, the waiting period for turning on the electric motor begins (when the engine is started manually). A sign of its inclusion is the presence of current through the measuring transformers. Standby indicator flashing idle indicator I <. The relay can remain in this position for any length of time. While waiting to start, the relay monitors the voltage and insulation resistance of the motor.

Mains voltage monitoring

The relay monitors the parameters of the supply voltage, and in case of their violation (increase / decrease in voltage), the U > / U < LED lights up, and the K LED lights up in red, which means that the output of the relay is turned off. The contact opens (without delay).

Control of motor insulation resistance

The relay controls the insulation resistance from the time it is energized until the electric motor is started, that is, until the current flow through the current transformers begins. After that, the monitoring of the insulation resistance stops and continues after a normal or emergency shutdown of the electric motor (shutdown of the circuit breaker). Restarting is prohibited if the insulation resistance is broken. The indicator of the decrease in insulation resistance is the svetadiode Riz<. is considered

Relay operation during start-up and engine operation

Current and voltage control.

During the start of the electric motor, the Tish relay monitors the currents according to the "idle (dry) operation", "current asymmetry" and "short circuit current" parameters. Control according to the "Current asymmetry" parameter is carried out according to the values of the working currents. The "Overload" parameter is not controlled, which ensures the selectivity of the relay of the starting currents of the electric motor. After the start-up time of the electric motor, current overload protection (3.8 ha), rotor blocking and voltage are additionally turned on. If the network parameters are violated, for example, in case of overvoltage, the LED U > lights up, and after a time delay corresponding to the programmed setting, the LED K

lights up in red, which indicates the opening of the relay output contact. If there are several emergency parameters at the same time, the LEDs can record only the parameter that triggered the relay.

Operation of the automatic restart (AQY) function

The device allows automatic restart (programmable from 0 to 5) during automatic operation of the electric motor. The restart occurs after the time specified by the settings. Automatic restart works only after the electric motor is turned off (that is, after the current flow through the CT is stopped) according to the following signal parameters:

- overload;
- current asymmetry;
- empty (dry) operation.

If the cause of the failure has not disappeared, after the end of the last AQU cycle, the operation of the relay is blocked. The relay remembers the controlled parameters at the time of the accident, displays them on the LED indicator and highlights the reason on the corresponding single LEDs. When the electric motor is turned off due to voltage drop or overvoltage during automatic operation of the motor, the number of starts is not limited. Start-up occurs after the voltage is restored within the specified limits, taking into account the hysteresis. After an emergency shutdown due to a blocked rotor, a short circuit (current interruption) or a sticking of the pusher contacts, re-starting is prohibited and the relay operation is blocked.

Reset the relay

The button should be pressed for (2-3) seconds (until the LEDs that indicate the reason for turning off according to the above parameters appear). When the relay is blocked, the operating parameters can be viewed, but the settings cannot be changed. The number of restarts should be set to 0 so that the relay remembers the parameters when the electric motor was turned off.

Overcurrent relay operation

The relay has the following types of protection in case of overcurrent:

a) by reverse time-current characteristic (optional): usually reverse characteristic (IEC 255-4) or straight characteristic (RT-80 relay type),

a) with rotor blocking,

c) vine section.

Protection mode according to the reverse characteristic of the time flow

The choice of the type of time current characteristic is determined when setting the relay operating modes (point H). The tripping time is calculated according to the value of the overload current I / Inom and the inverse time-current characteristic Setting the tripping time according to Tust. Characteristics of the dependence of the operating time on the amount of overload current at the input current from 1.2 to 10 Inom:

generally reverse characteristics (MEK 255-4):

flat time-current characteristic (RT-80 relay type):

When the value of the motor current exceeds 1.2 Inom, after a time delay corresponding to the calculated shutdown time, the red LED K lights up, which indicates the opening of the output relay contact. For inverse time-flow features, the maximum runtime is limited to 100 s. A graphical representation of these features is provided in Appendix A.

Locked rotor mode

A second stage of protection is provided for faster response to overcurrent after start-up due to stalling of the motor (locked rotor) or short circuits in its winding.

Set as a multiple of inom in the range (1,1…6). The setting of the working time for blocking the rotor is from 0.1 to 99.9 s.

Vine cut

The current cut is used to protect against short circuits and works both during start-up and in all other operating modes of the electric motor. The current cut level setting is set as a multiple of Inom in the range (6…10). Response time - (50-100) ms.

Relay connection. Before connecting to the relay output terminals of the load, it is necessary to program the parameter settings according to table 4, taking into account the operating parameters of the connected electric motor, and, if necessary, enable or disable the control. The value of the rated current settings must be equal to or greater than the rated operating current of the motor. The settings memory is non-volatile and can save the values during the entire operation

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