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CONTEXT / MUNDARIJA

Development of the button relay scheme and algorithm of the dial group microprocessor blocks controlling two combined shunting traffic lights of the railway automation and telemechanics system

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Abstract: Today, in all developing countries, one of the urgent problems of development of not only railway transport, but also other sectors, the economy as a whole, is the introduction of energy and resource-saving technologies and determining the ways of their effective use. This article analyzes the centralization systems in railway automation and telemechanics and considers the issue of improving the dialing group blocks (NM2P and NM2AP) controlling two unified shunting traffic lights of the BMRM system, i.e. creating their microprocessor representation, developing algorithms for each working chain. There are several electric switching systems in the road automation and telemechanics system, and among them, the block route relay switching system has been actively used for many years, and this system is much faster than other systems because it is installed in a large number of railway stations. improved.
Keywords: relay, relay system, route, shunting traffic light, electromechanical, microprocessor system, microelectronic, microcontroller, optocoupler.

1. Introduction

Currently, a number of microprocessor centralization systems, which are developing rapidly, have been developed based on the block-routed relay centralization (BMRM below) system. Because in the BMRM system, the safety and reliability requirements of devices are implemented at a high level and have been tested in the production process for a long time. Therefore, the use of the BMRM system architecture and performance algorithm in creating modern centralization systems is one of the most alternative solutions. In this regard, it is also worth noting that the introduction of new and modern microprocessor centralization systems does not always increase economic efficiency, because the cost of such systems requires many years to pay for themselves. In addition, it is much easier and more cost-effective to upgrade parts of an existing system in sequence than to completely upgrade it.

2. Methodology and empirical analysis

In order to develop a modern microprocessor version of the dial group block NM2P, which controls two combined maneuvering traffic lights in the BMRM system, we analyze the button relay circuit (Fig. 1) and the operation algorithm in the block.

The button relay serves to fix the pressing of the route button on the control panel of the station attendant.

A pushbutton relay is normally de-energized and can be energized in two ways:

- by pressing the buttons on the station attendant's control panel;
- through automatic button relay (AKN) contacts;

Push-button relays receive power through the first chain of interconnections of the dial group blocks and are de-energized only when the PU and MU controlling the arrow switches or the signal relay is energized.

The push-button KN relay in the dial group unit NM2P, which controls two combined maneuvering traffic lights, can be energized when one of the following conditions is met.

Condition 1. There should be a supply at the THM point, the K relay contacts should provide a common forward connection, and there should be a connection with the 1-1 point. This situation can be expressed by the following formula (1)

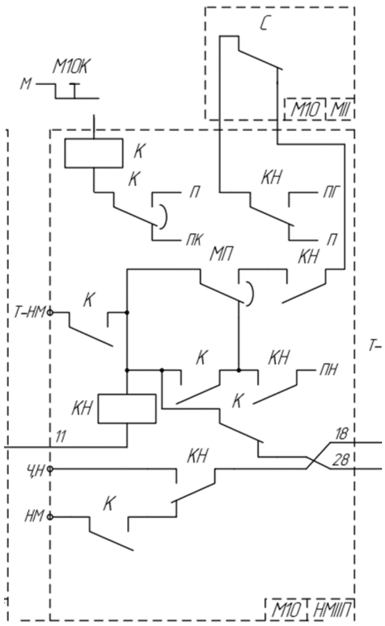

Figure 1. Button relay circuit in the NM2P block

$$[T - HM \cap K \cap (1-1) = 1][KH = 1](1)$$

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Condition 2. In the next case, the presence of supply at the input of the block (2-8), the connection of the contacts of the relay K and the connection with the point 1-1 will bring the relay KN to the current state. This situation can be expressed by the following formula (2)

$$\left[(2-8)\cap\overline{K}\cap(1-1)=1\right][KH=1](2)$$

Condition 3. Supply is available at PN input, common and forward contacts of relay KH are connected in energized state, common and forward contacts of relay K are connected and there is a 1-1 point connection KN relay is energized through self-locking circuit causes. This can be expressed as (3)

$$[\Pi H\cap KH\cap K\cap(1-1)=1][KH=1](3)$$

Condition 4. The presence of supply at the PN input, the common and forward contacts of the KH relay are connected in the live state, the MP relay is de-energized, i.e. the common back contacts are connected, and there is a connection with 1-1 point, the second self of the KN relay through the locking circuit to the live state. This can be expressed as (4)

$$\left[\Pi H\cap KH\cap\overline{M\Pi}\cap(1-1)=1\right][KH=1](4)$$

Condition 5. (1-9) if there is a supply at the input, the common and front contacts of the KH relay are connected in the current state, the common and front contacts of the MP relay are connected and there is a connection with point 1-1, the KN relay is turned on by itself. through the locking circuit to the live state. This can be expressed as (5)

$$[(1-9)\cap KH\cap M\Pi\cap(1-1)=1][KH=1](5)$$

Based on the mentioned conditions, the working algorithm of the KN relay (Fig. 2) is as follows.

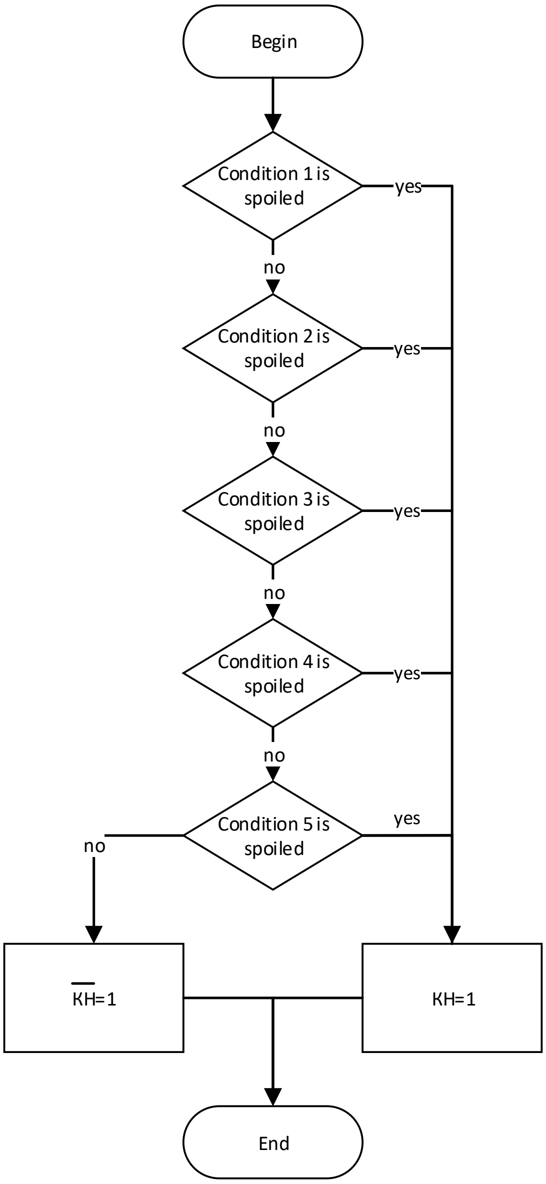

Figure 2. Working algorithm of the KN relay

Next, we will analyze the operation algorithm of the button relay circuit (Fig. 3) in the NM2AP block, which controls two combined maneuvering traffic lights in the BMRM system.

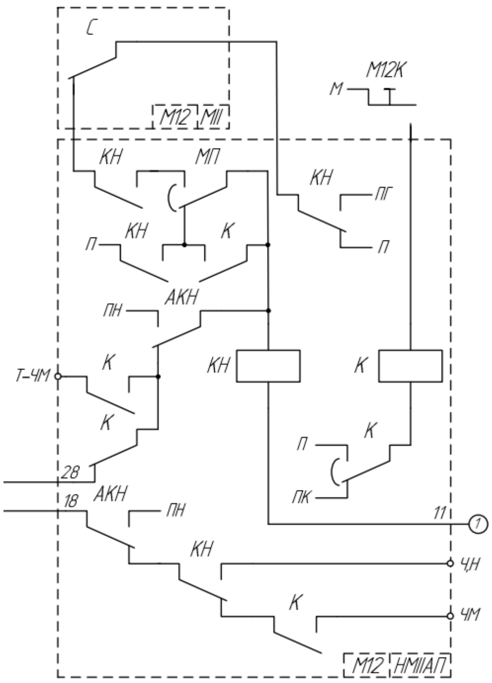

Figure 3. Button relay circuit in the NM2AP block

The pushbutton KN relay in the NM2AP dial group unit can be energized when one of the following conditions is met.

Condition 1. There should be a power supply at point THM, contacts of relay K should provide a common forward circuit, contacts of relay AKH should be de-energized, i.e. in a common reverse circuit, and there should be a connection with point 1-1. This situation can be expressed by the following formula (6)

$$\left[T - HM \cap K \cap \overline{AKH} \cap (1-1) = 1\right][KH = 1](6)$$

Condition 2. In the next case, there is a supply at the input of the block (2-8), the contacts of the relay K are connected to the common back contact, the contacts of the relay AKH are in the common back, and there is a connection with point 1-1, the KN relay is energized. This situation can be expressed by the following formula (7)

$$\left[(2-8) \cap \overline{K} \cap \overline{AKH} \cap (1-1) = 1\right][KH = 1](7)$$

Condition 3. The presence of supply at the PN input, the common and front contacts of the AKH relay in the current state, and the connection with the 1-1 point will bring the KN relay to the current state. This can be expressed as (8)

$$[PH \cap AKH \cap (1-1) = 1][KH = 1](8)$$

Condition 4. There should be a supply at the PN input, the common and front contacts of the KH relay are energized, the MP relay is de-energized, i.e. the common back contacts are connected and there should be a connection with 1-1 point, self-locking of the KN relay. through the chain to the current state. This can be expressed as (9)

$$\left[PH \cap KH \cap \overline{MP} \cap (1-1) = 1\right][KH = 1](9)$$

Condition 5. The presence of supply at the PN input, the common and front contacts of the KH relay energized, the K relay energized, and the 1-1 point connection causes the KN relay to be energized through the second self-locking circuit. . This can be expressed as (10)

$$[ПН \cap KH \cap K \cap (1-1) = 1][KH = 1](10)$$

Condition 6. (1-9) there is a supply at the input, the common and front contacts of the KH relay are connected in the energized state, the common and front contacts of the MP relay are connected and there is a connection with point 1-1, the third self-off of the KN relay zi is energized through the locking circuit. This can be expressed as (11)

$$[(1-9) \cap KH \cap MП \cap (1-1) = 1][KH = 1](11)$$

Based on the mentioned conditions, the working algorithm of the KN relay in the NM2AP block (Fig. 4) is as follows.

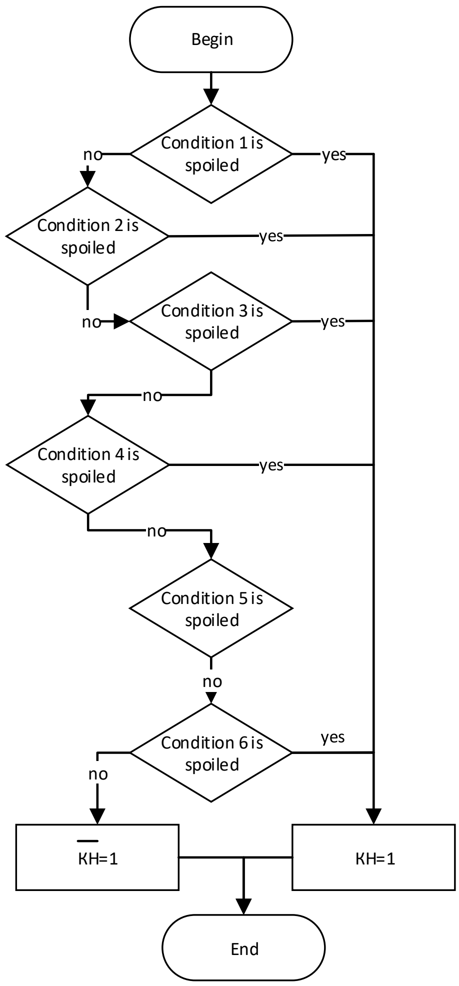

Figure 4. KN relay operation algorithm in the NM2AP block

In addition to KN button relay, NM2AP block also has AKH automatic button relay. The AKH relay switches to the ON state when the following conditions are met.

Condition 1. There should be a supply at the 2-2 access point, the connection of the common back contacts of the KH relay and the connection with the 1-2 access point should be available. It can be expressed as follows.

$$[(2-2) \cap \overline{KH} \cap (2-1) = 1][AKH = 1](12)$$

In addition, the following two expressions ensure that the AKH relay with 13-14 arcs is switched to the current state through a self-locking circuit.

$$[(1-22) \cap AKH \cap AKH \cap K \cap (2-1) = 1][AKH = 1](13)$$

$$[(1-22) \cap AKH \cap K \cap (1-1) = 1][KH = 1](14)$$

The working algorithm of the AKN relay in the NM2AP block is as shown in Figure 5 below.

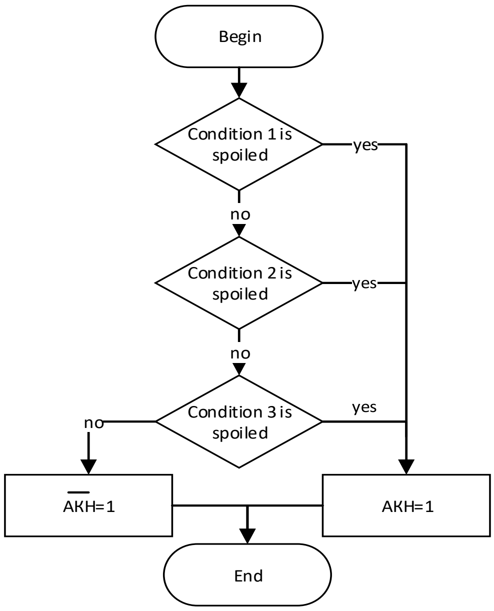

Figure 5. AKN relay operation algorithm in the NM2AP block

3. Results

In the NM2P dial group unit controlling two combined maneuvering traffic lights, we will develop a functional circuit and replace the electromagnetic relay and its contacts with microelectronic devices in the KN relay circuits. In this case, using PS-817 instead of the electromagnetic relay, and PVG-612 S-type optocouplers instead of the relay contacts, the KN relay switches to the current state based on the 1st condition, the functional scheme is as follows Fig. 6.

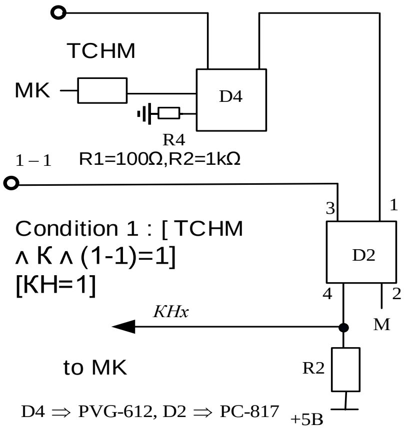

Figure 6. Functional scheme of the KN relay supply chain based on condition 1

4. Conclusion

The improved modern microprocessor block of dialing group blocks controlling two combined shunting traffic lights of the proposed railway automation and telemechanics system has advantages over electromagnetic relay blocks with energy efficiency, compactness and compactness. Another major advantage is that the production of this type of microprocessor units is done locally and is cost-effective. This, in turn, eliminates dependence on foreign enterprises in the sector. Microelectronic optocouplers and semiconductors are used instead of electromagnetic relays to create an improved version of the dial group block controlling two combined shunting traffic lights in the centralization system with a block route relay. The operating algorithms of the electromagnetic relay block are analyzed, and software is written for the microcontroller based on these algorithms.

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