# Microelectron NPC block and its function

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| Abstract: | Railway switch control systems on railway are essential to ensure safe and efficient traffic. In this article, the development of automated control systems of railway switches, their technological basis, safety issues and energy efficiency improvement approaches are considered. The main attention is focused on the production and practical use of a microelectronic alternative version of the relay NPC block, which belongs to the dialing group, of modern control blocks, in particular, based on the technical requirements for railway automation and telemechanics equipment, and their harmonious operation with telemechanics tools. |
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| Keywords: | class II relays, VU, PVU relays, current sensor, optocouplers, light-emitting diodes, modern microcontroller boards, dial group block |

## 1. Introduction

Modern practice has shown that relay, mechanical, processor-relay railway transport automation and telemechanics systems have a number of disadvantages, their use is limited and technically ineffective. Currently, relay devices that perform interconnection of switches and signals are increasingly being replaced by microprocessor systems. This is due to the following reasons.

Firstly, maintenance of microelectronic systems compared to relay systems, the high cost of such systems shows that their implementation is economically feasible.

Secondly, indicators of microelectronic systems due to the use of excess reserves of individual constituent elements of the system and advanced diagnostic systems.

Thirdly, by providing employees with quick information and by expanding the functional capabilities of the systems due to the simple integration of railway automation and telemechanics microelectronic systems into high-level train traffic control systems (DM, control centers, etc.).

Taking into account the above, in this article, I propose to develop a model of a microelectronic NPC unit consisting of microelectronic devices, intended for use in centralizing relay-processors and microprocessors of the dial group.

## 2. Methods and materials

In order to give solution these we should do below in the following tasks:

- Based on modern foreign experiences, development of the program and principle scheme of relays of NPC blocks with microprocessors, which are efficient and flexible to work in old systems, for "Uzbekistan Railways" JSC.

Modern microprocessor-based centralization systems are mainly divided into 2 types: Type 1 is a system built on top of old relay systems, in practice, the relay performs the function of the lowest step, and it is a relay-microprocessor control system in which the result is recorded and controlled by microprocessors. Type 2 in which commanding devices is fundamentally different from the previous system, the system management is handled by servers located in cross cabinets.

We cannot completely separate the actual system from relays, so in this process, we can make some improvements to the problem by making a view of the new block composed of other elements that perform the same task, using microelements that replace relays, that is, semiconductors (Figure 2). and for many years we can create a new microprocessor-relay system that is as free from defects as possible, and in practice we can see that this system is speeded up several times. And the fact that testing this system in practice should be done using the skills of the old system makes our work much easier.

- NPC type group block functions done increase for there is technical solutions analysis to do;
- By block executable functions and of the NPC block algorithm analysis to do;
- The NPC block electron scheme and microelectronic in the elements known switching schemes analysis to do;
- STM32 microcontroller work scheme by learning exit and to him code to write for need C programming to be language with skills harvest do;
- Laboratory of the model work exit and his work analysis to do.

**Main issues and assumptions.**

- Familiarization with the structure of the unit and analysis of its specific features, the program and principle scheme of the PVU and VU relays of the NPC (Figure 1) blocks of the dialing group currently used in the block route-relay centralization systems;
- Acquaintance and analysis with the structure of blocks used in modern microprocessor centralization systems and performing exactly this type of task;
- Analysis of the experiences of foreign countries in the organization of work in the process of operation of button relays in railway systems;
- Learning and analyzing the rules for identifying and using microcontrollers and other types of microelectronic devices necessary for the development of a microprocessor block;

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- In the development of the microprocessor unit, selecting the ones that are suitable in all respects for the conditions of Uzbekistan.
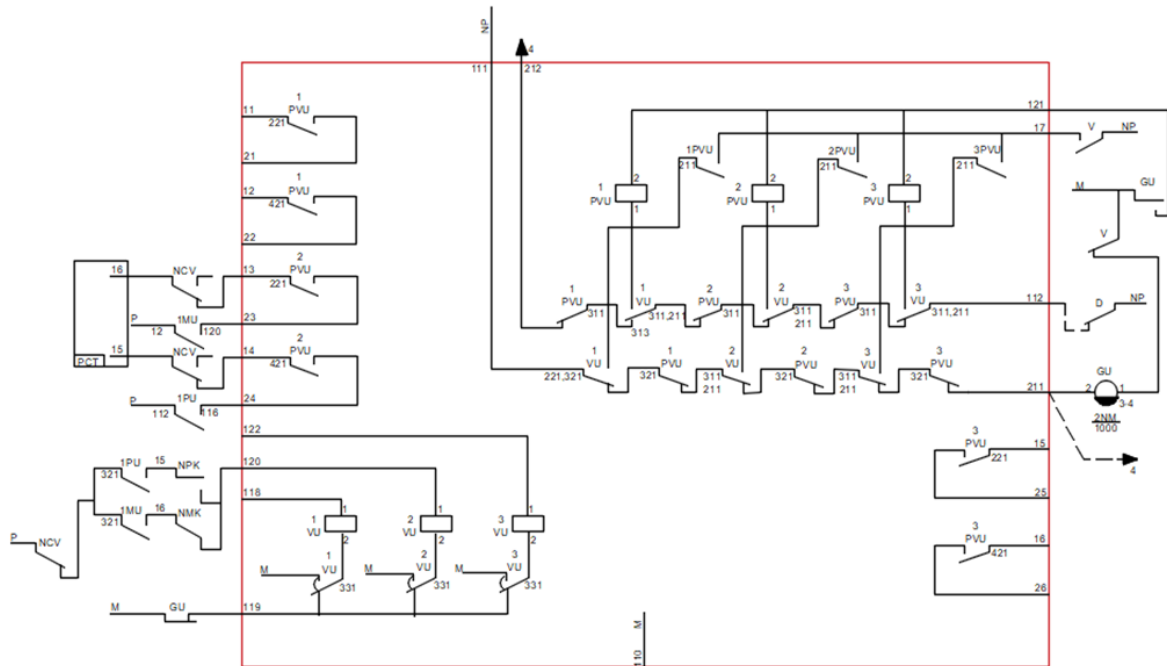


**Figure 1. NPC block with relay principle appearance**

Relay equipment dialing group blocks provide:

- pressing keys when dialing routes and remembering them;

- determine the direction and category depending on the state of pressing the start route buttons; turn on the route light to properly control the route being built;

- determining the correctness of the sequence of pressing the route keys when the last button of the route is pressed and the routes with different options are created;

- at the start of the route, the control and starting devices are activated so that the arrows move to the second position at the same time;

- for this route, the compatibility of the established route is checked;

- cancellation of the configured route, turning on the start and end relays of the maneuver to determine the route limit in the executive group schemes of the centralization;

- auxiliary mode of signaling and control of the route configured on the dashboard.

**Automatic turnout control systems:** modern technologies of automation, use of remote control and monitoring systems. Automatic turnout control systems are one of the most important technologies for ensuring traffic safety in railway transport.

These systems keep trains moving in the right direction by controlling the switches quickly and accurately, preventing them from going off the wrong track or colliding. Modern technologies this systems more advanced, efficient and reliable in doing big role is playing.

**Automation modern technologies.**

Railway transport for automation processes technological in terms of much improved. Current in the day swithes of management the following modern technologies applies to:

- **PLC (Programmable Logic Controller)** based on management systems: PLCs railway switches in automation very wide is used. They are software in terms of managed and high precision with switches necessary to the situation transfer enable gives.

- **SCADA (Supervisory Control and Data Acquisition)** systems: This systems using switches from a distance managed and is monitored. They are real time information collection, processes observation and management signals transmission enable gives.

- **Sensory technologies:** Sensors using arrow position and his right performance is monitored. Through this of switches status constant respectively observed and safety level is increased.

- **IoT (Internet of Things):** Switches and another railway devices Internet network through each other with in touch is remote monitoring and management more makes it easier.

**Remote management.**

Remote management technologies switches long from a distance standing up manage enable gives, this while the speed increase and of operators duties to ease help gives:

- **Central management systems:** Management in the centers arrows in real time observation and manage for to operators special interfaces present will be done. Collection of NPC group block route make up in the process long in the distance arrows to see and to them command to give can.

- **Remote software management:** Mobile devices or computer programs through arrows remote managed. This is especially so small stations or big to distances have networks for it is convenient.

**Monitoring systems application.**

Monitoring systems switches status and technical work observation for is used. Modern monitoring technologies of switches technical status constant respectively watching standing, malfunctions or problems about warning enable gives.

- **Sensors and cameras using observation:** These monitoring tools using switches their location technical condition and movement speed sure observed . Automatic signaling through each how malfunction quickly is determined and correction for remedy will be seen.
- **Cloudy storage and analysis :** Monitoring data cloudy in systems saved , statistic analysis will be done . And this of the system efficiency analysis to do and technical service of showing in advance to be planned provides.

**Automatic management systems advantages.**

Switches automatic of management modern technologies the following advantages present will:

- **Movement safety increases:** Switches automatic respectively managed because of a person mistakes decreases, this while movement safety provides.
- **Speed and efficiency:** From a distance manage and automation fast management providing, train movement to slow down the need reduces.

- **Technician service of showing optimization:** Monitoring systems malfunctions in advance to determine opportunity gives, this while technical service to show more efficient does.

This technologies switches efficient manage through iron road transport safety and efficiency significant level to increase possibility gives.

- **Innovations and technologies:** Current in the day being used software supply and technological solutions. For example, through NPC arrows management.

**Safety issues:** Technician security, electricity supply and of systems to the violation against to fight methods. Emergency situations for of the system security provide ability.

- **In the future development prospects:** Switches in management artificial intellect and analysis from algorithms use, himself manager of systems development.
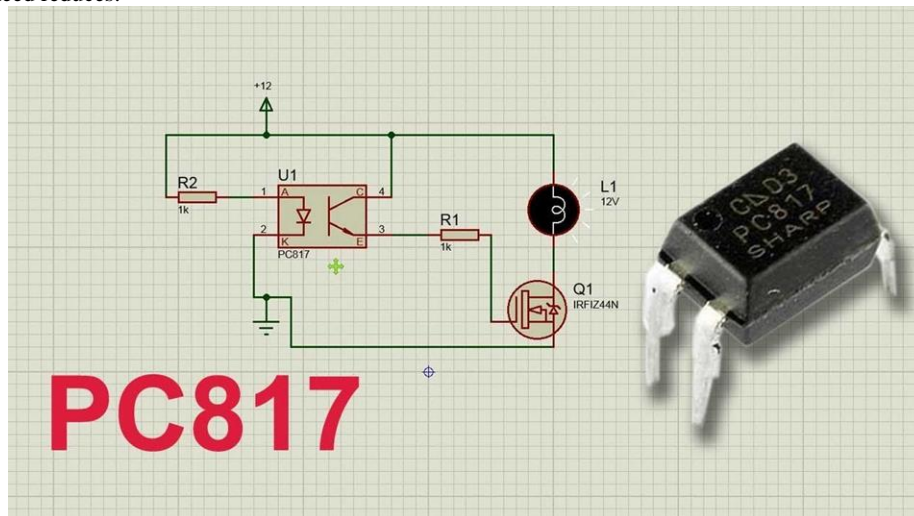


**Figure 2. PC-817 optocoupler (half junction transistor)**

# 3. Conclusion

Railway switches automation and them manage technologies more development not only movement safety provides, perhaps energy efficiency increase and exploitation expenses also great in reduction important have modern technological approaches and innovative systems railway in transport more reliable and safe management provides.

Microprocessor control of switches when setting routes based on the technical requirements for railway automation and telemechanics equipment block implementation methods, algorithms and software have been developed. As a result of this, microprocessor blocks of switch control were created that meet the requirements of the continuity of train movement, localization of production, application of energy and resource saving technologies. As a result of scientific research, it was possible to abandon the use of electromagnetic relays, reduce electricity consumption, abandon scheduled maintenance, adapt to work with existing relay blocks.

Increase the continuity of transportation process control, the NPC (Figure 1) microprocessor block is being developed, which is used as the main block of remote switch control of railway automation and telemechanics, based on the relatively more functional "STM 32F103" microcontroller . As a result of scientific research, the possibilities of introducing a diagnostic function, abandoning electromagnetic relays, reducing energy consumption, increasing the reliable performance of the unit, and abandoning scheduled maintenance have appeared. All electrical circuits will be preserved when replacing the existing blocks of arrow control based on KDR type electro-magnetic relays with microprocessor blocks. The created microprocessor blocks enable the active use of resource-saving technologies in railway automation and telemechanics systems, allowing to reduce energy consumption.

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