

UDC 53-004

**ENHANCEMENT OF RAILWAY AUTOMATIC EQUIPMENT
BY MEANS OF COMPUTER NETWORKS IMPLEMENTATION**

Amochaeva G.P., Omarbekova G.I., Seisenbayeva G.S.

Karaganda State University named after E.A. Buketov, Universitetskaya Str.28, Karaganda, 100026, Kazakhstan,
galina_amochaeva@mail.ru

The computer systems operational management of train traffic, intended for backbone and industrial vehicles are examining in this article. This is system based on the distributed controlled points and centralized traffic control system which based on microcomputers and programmable controllers. Its composition, functionality for practical use at the stations of the Karaganda branch of JSC "Temir Zholy" were analyzed in this work. The future of electric centralization determined by the transition from a microprocessor-based relay systems. The introduction of microprocessor systems automates operations supervisory personnel, contributes to the creation of automated systems for traffic control, have higher rates of efficiency through integration.

Keywords: auto locking, block telesignalization, distributed controlled points, communication links, semi-automatic lock.

Introduction

Devices of automation are the most important elements of technical equipment of railway transport. These devices allow to solve effectively problems of transportation process, promoting increase in carrying capacity of railway lines, ensuring traffic safety of trains, continuous communication between all subdivisions of railway transport.

The devices of automation and communication used on railway transport include: the means of automatic equipment and telemechanics regulating train service on stages (electro staff system, semi-automatic lock, auto locking); the automation and remote control devices controlling arrows and signals at station (electrical and mechanical centralization of arrows); the centralized traffic control integrating auto locking and arrow centralization; telephone, telegraphic and other types of wire communication, radio communication; passenger automatic equipment. Equipment with these devices can provide the railroads of Kazakhstan an optimum level of these systems equipment and double volume of transportations, than now [1].

Implementation of the modern multifunctional and high-performance measuring systems and mobile complexes will allow to automate many technological operations, and as a result, to reduce labor costs.

Object of research

It should be noted that the process of identifying failures and violations of operating systems and complexes "closed" within "their" automation object (stations hump, signal point, and others.). The geographically distributed objects automation, control and autonomy of its diagnosis does not allow for a comprehensive integrated analysis and forecasting of the state of alarm devices, centralization and blocking at the level of signaling, railway departments, regions and the Department of automation and remote control in real time.

So this problem is to improve the system of maintenance and repair of devices of railway automation and remote control currently holds the highest priority to the task of improving road safety and the introduction of resource-saving technologies [2]. The introduction of a multi-level network of automated system of technical diagnostics and condition monitoring alarms, centralization and blocking with simultaneous control of the implementation of maintenance and

repair work with the appropriate archiving is now a major problem for the economy of automation and remote control.

An analysis of the computer systems of railway automation.

The system based on the distributed controlled points.

The modular principle of creation of system on the basis of distributed controlled points (DCP) provides high unification, technological effectiveness in mass production, simplicity of volume change of the performed functions and configurations. The functional and structural decentralization of the system on the basis of the local network architecture distributed controlled points provides its high reliability. Use of units distributed controlled points - remote control unit (DCP –RCU) and distributed controlled points - block tele-signalization (DCP –BT) which are mounted on the basis of the NMW relay and are installed on the relay rack neutral compact plug relay socket, promotes reduction of the relay equipment (racks, the relay, relay units, etc.), and also the volume of installation works and intra cable.

Units DCP –RCU are intended for switching on the controlling relays on commands of telecontrol of the train manager. One unit DCP –RCU allows to switch up to eight controlling relays [3].

Units DCP –BT serve for input the controlled signals. One unit allows to process up to 20 signals of the hardware. The number of units is defined by quantity of signals.

Redundant units of DCP Centre are intended for input, processing of all signals which arrived from units DCP –RCU, DCP –BT and data transmission to PC. The unit of DCP Centre is developed in the form of a wall case with a set of electronic boards, one is set in relay location, one of them is in the intermediate station.

Centralized traffic control system based on microcomputers and programmable controllers.

The centralized traffic control system based on microcomputers and programmable controllers provides implementation of functions of control and monitoring of the dispersed objects and it is applied when dispatching, automation and concentration of control. The system is modern, open and stackable, easily adapts for conditions of a specific polygon of control when design and their change during operation.

Besides, the equipment of system can be used for the purpose of:

- providing of step-by-step changeover of equipment of other systems of telemechanics, when transfer or upgrade of dispatcher' workplaces;
- control of adjacent stations (mini centralized traffic control);
- the organizations of dispatching centers of supervisory control with possibility of combining Automated workplace-equipment of operation dispatcher personnel in a local area network;
- information transfers about the control polygon status in higher hierarchical levels of control.

The centralized traffic control system based on microcomputers and programmable controllers consists of:

- devices of the central point of control (PC) which are set at the train manager's (regional or road center, etc.) and can be integrated by a local area network;
- equipment of the linear controlled points (CP) on the basis of programmable controllers or PC of systems "Ray ", " Neva";
- communication links between PCs;
- communication links and local area network for combining PC with other systems and levels of control.

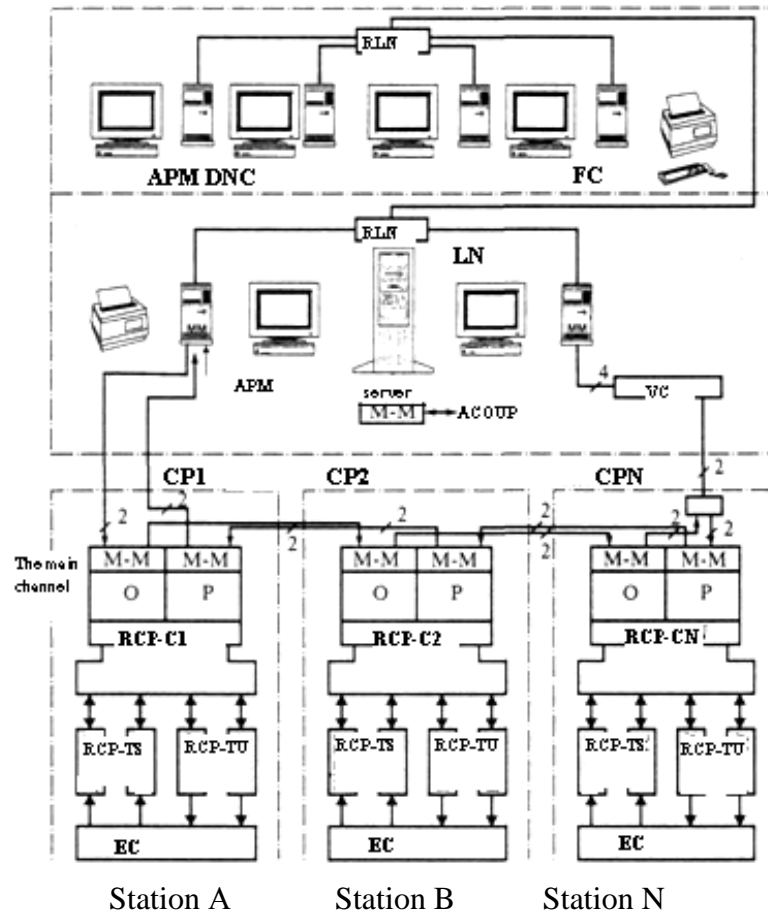


Fig.1. The structure diagram of systems on the railroad with distributive controlled points

Automated workplaces of managers of other households (signalization, centralization and blocking (SCB), locomotive, carriage, power supply) can be connected to local area network of Automated workplace-equipment of train managers and contain the equipment necessary for implementation of these functions. Information exchange between components of system is based on standard protocols of computing systems and local area networks [4].

The centralized traffic control system based on microcomputers and programmable controllers equipment is compatible to information systems of automated output of warnings; higher systems of long-time planning of road level (by Automated workplace-equipment of road managers). For information exchange with the specified systems the sporadic method with handshake of messages is used. Control of transportation process is exercised by the train manager. For support of its continuity in case of failure of SCB devices removal of block dependences and transmission of responsible commands are provided. In this case all responsibility is conferred on two people: the train dispatcher and the person on duty on department [5].

Equipment of central control point.

Central point of the dispatcher circle is usually in the building of station or rail-way control. It represents an automated workplace of the train manager which is realized on the basis of the modern calculating equipment (fig. 2). At PC of one dispatcher circle two computers are used: the main (i.e. realizing telecontrol commands) and reserve which is in operation permanently.

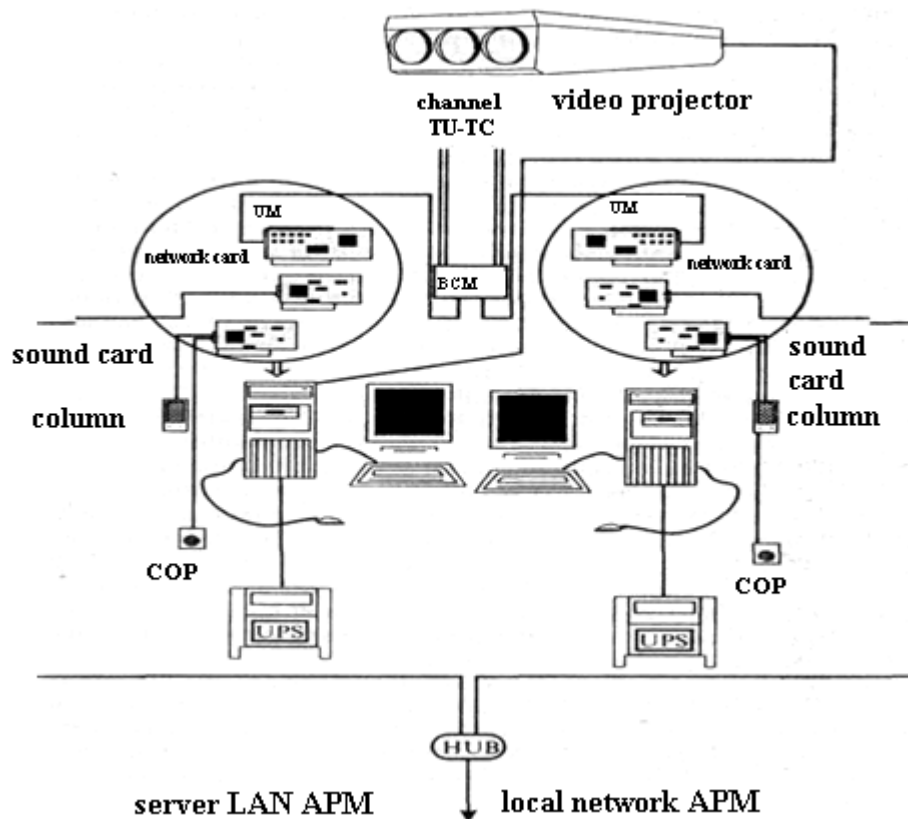


Fig. 2. The structure diagram of the central post of system of centralized traffic control system based on microcomputers and programmable controllers.

Equipment of the linear controlled point

The linear PC represents a complex of the software and hardware tools intended for collection, processing, transmission to PC the information about the condition of on-off objects and reception from PC and execution of telecontrol commands. PC consists of two sets of 100% reserve equipment on the basis of programmable controllers (the main and reserve). The reserve set is in switched on condition, working condition and is ready to pass into the active status. Switching the sets is carried out automatically - thanks to mutual monitoring of semi-sets; the command arriving from PC (in case of origin of systematic failures); buttons on the PC front panel for execution of repair and scheduled maintenance by the service personnel.

The complex of PC devices, as a rule, settles down in relay location. At the stations of automated control PC, for costs reduction of the equipment, can be on the table of station duty person. The equipment of PC is placed in electrotechnical case which has dust- and moisture protective construction.

The PC controller consists of the following components (fig. 3): the industrial single board computer SSC-5x86H based on basis of architecture of the processor 486 and containing the central processor AMD486-DX2, videoadapter, keyboard controller, non-volatile memory on the basis of the chip Flash with the capacity 2 Mb, RAM up to 64 Mb, system of ports for connection of external devices (hard, floppy disks), a loudspeaker; two I/O cards; network interface card; the universal modem; boards of analog signals processing [6].

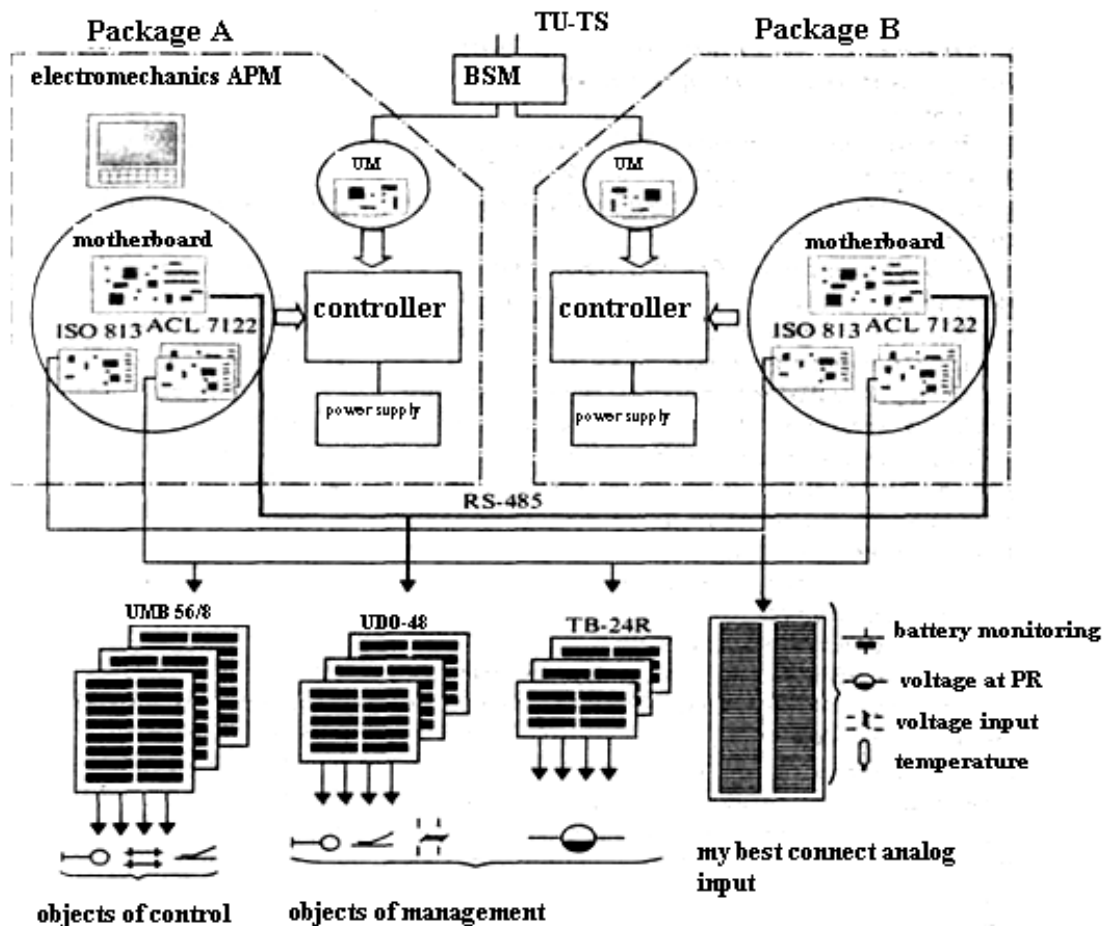


Fig.3. The structure diagram of the linear post of system of centralized traffic control system which based on microcomputers and programmable controllers

Conclusion

The strategy of further renewal and development of the economy of automation and remote control, which is based shall be the achievement of the following indicators:

- improving traffic safety by introducing modern systems with self-diagnosis and functions, logical control over the actions of the operator and maintenance personnel to minimize the "human factor"
- lower operating costs in all farms by optimizing traffic control, increasing the level of its centralization;
- reduced maintenance costs for maintenance of railway automation and remote control and reducing the costs of energy supply by increasing the introduction of microprocessor systems;
- implementation of sparsely populated and resource-saving technologies;
- reduction of aging hardware of railway automation and remote control.

In the context of such a strategy the above microprocessor systems of railway automation and remote control by using modern software and hardware technical means have powerful functionality and provide a solution to problems of automatic control and diagnosing outdoor signaling devices, centralization and blocking.

REFERENCES

1. Bubnov V.D., Kazakov A.A., Kazakov E.A. *Station devices of automatic equipment and telemechanics on railway transport*. 2006, M: Info, 359 p.
2. Dontsov V. K. *Transfer systems of automatic equipment and telemechanics*. 1992, Yekaterinburg: Nauka Urala, 178 p.
3. Pochayevets V. S. *Automated control systems for devices of electrical power supply of the railroads*. 2003, M: Marshrut, 120 p.
4. Yakovlev V. F. *Automatic equipment and automation of production on railway transport*. 1990, M: Transport, 279 p.
5. Kaziev G.D. Prospects for the introduction of new devices and systems of railway automation and remote control. *Automation, communications, informatics*, 2006, No. 11, P. 13.
6. Kovkin AN Safe control of analog objects in railway automation systems. *Automation and Remote Control of Russian railways. Engineering, technology, certification. Collection of Scientific Papers of the Petersburg State University of Railways*, 2008, pp. 58–62.

Article accepted for publication 27.04.2015