



PRODUCTS AND SOLUTIONS
of the Signaling Division
of 1520 Group of Companies
for mass transit



THE SIGNALING DIVISION OF THE 1520 GROUP OF COMPANIES

The Signaling Division of the 1520 Group of Companies is one of the top 5 global producers of the train traffic control and safety systems. The Division unites the leading Russian companies that develop innovative technical solutions. Its project geography covers all CIS countries, the Baltic states, Eastern Europe, the Balkans, Turkey, and Mongolia.

The Division provides a range of services throughout the entire life cycle of the signaling equipment for the Metro.





MASS TRANSIT SOLUTIONS OF THE SIGNALING DIVISION OF 1520 GC

The Signaling Division of the 1520 Group of Companies cooperates with the Metro of Russia and other CIS countries supplying various signaling devices – from the electric point machines to the computer-based systems.

Since 2018 the Signaling Division supplies the Metro of Moscow and Tashkent with up-to-date digital interlocking and traffic control systems, modular power supply systems along with the full range of relay and wayside equipment. At the Moscow Metro the digital systems have managed to provide the record short train interval – 80 sec.

DIGITAL TRAFFIC CONTROL SYSTEMS

Computer-based and hybrid interlocking systems **CBI-EL**, **CBI-SM** and **HIS-EL** in its metro modifications provide for the hot standby of all electronic components, including object controllers, data links and electronic equipment of track circuits. Thus, the maximum availability of the signaling systems and devices is ensured which is especially important at high-traffic mass transit lines where the uninterrupted train traffic is one of conditions for safe and sustainable transport system operation.

All electronic modules of interlocking systems for Metro are of dust-proof design. The CBI systems are supplemented with the enhanced cybersecurity systems which ensure connection to the remote monitoring LCSS in the single metro control centre and guarantee the protection of the system internal network against cyber attacks from external networks.

The Traffic Control System based on reliable and functional **Digital Track Circuit Monitoring Modules (DM-TCC-M)** with audio frequency track circuit coding using ARS frequencies became widely spread in the Moscow and Tashkent Metro. These modules are connected to the interlocking systems via digital or relay interface.

The digital signaling systems proven-in-use in the Moscow and Tashkent Metro are capable of ensuring reliable train traffic control in mass transit sector of other cities of “1520 area”.



MASS TRANSIT KEY TECHNOLOGIES AND PRODUCTS

- Computer-based and hybrid interlocking systems.
- Computer-based traffic control system.
- Workstation system.
- The Automated system for metro train traffic dispatch control.
- The Automated system for tram traffic integrated control.
- Enhanced cybersecurity systems.
- Electric point machines.
- Signals, signs and markers.

MILESTONES OF IMPLEMENTING THE SIGNALING DIVISION DIGITAL SYSTEMS for mass transit

HYBRID INTERLOCKING SYSTEMS HIS-EL

In 2018 in the first **hybrid interlocking system HIS-EL** was implemented in the Moscow Metro. Thereby an important preparatory step was carried out in order to deploy digital signaling systems in the capital's Metro. Three HIS-EL systems are used in the electric depots of the Moscow Metro now.

THE FIRST MODULAR COMBINED POWER SUPPLY UNITS IN THE METRO

At the end of August, 2018 seven new stations of the Solntsevskaya line of the Moscow Metro were opened. Five of them were equipped **with modular combined power supply units (MCPSU)** manufactured by Signaling Division of 1520 GC. Now MCPSU are

implemented at 64 stations of the Moscow and Tashkent Metros providing reliable power supply for the computer-based interlocking systems.

THE FIRST COMPUTER-BASED TRAFFIC CONTROL SYSTEMS (TCS)

In June, 2019 **computer-based traffic control systems TCS** were commissioned on the basis of a Digital Track Circuit Monitoring Modules (DM-TCC) at eight stations of the Sokolnicheskaya and Nekrasovskaya lines of the Moscow Metro.

By midyear 2023 such systems were implemented at 64 stations of the Moscow and Tashkent Metro. The innovative traffic control systems (TCS) provide the capacity of at least 48 train pairs per hour.

RUVIO relay controllers of HIS-EL in the Moscow Metro Solntsevo electric depo



The Moscow Metro Circle Line is switched under the digital signaling systems control



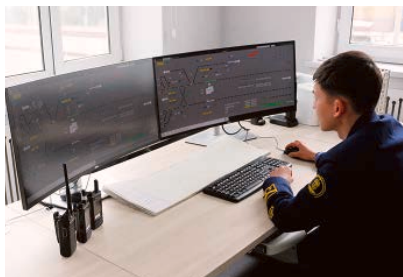
The wayside equipment of the signaling systems in the Moscow Metro



The Circle line of the Tashkent Metro is ruled by the digital signaling systems

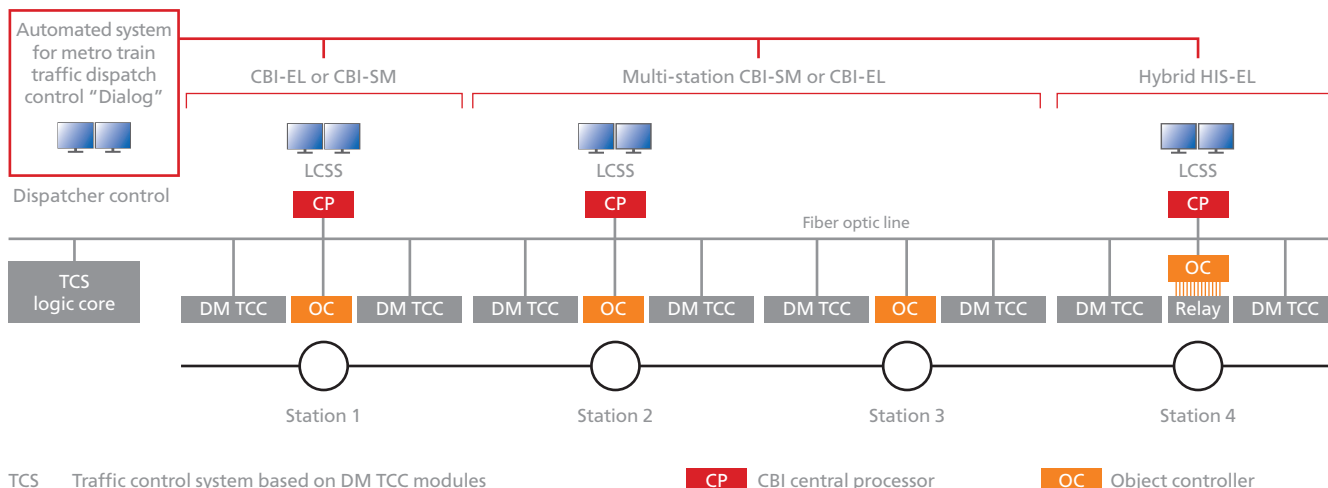


LCSS of the Dialog system in the Tashkent Metro



The automated system for tram traffic integrated control is actively installed in Moscow on the tram lines





The Signaling Division digital systems modified for Metro

THE FIRST-EVER CBI-EL IN THE MOSCOW METRO

CBI-EL, the first computer-based interlocking system in the Moscow Metro, was commissioned in the Sokol electric depot on the 9th of April, 2021. This system is produced out of the domestic hardware components and adapted for the metro conditions. Before implementation it was tested at the Troparevo station. By midyear 2023 the CBI-EL systems were operated at 12 stations of the Circle Line and in two electric depots. The Metro Circle Line of the Russian capital was switched to the digital signaling systems in January, 2023 without any train traffic interruption.

THE CBI-SM SYSTEM IN MOSCOW AND TASHKENT

In 2020 comprehensive tests of the **computer-based interlocking system CBI-SM** were completed successfully at the Novokosino station. It is the second CBI system developed and produced by the Signaling Division of the 1520 Group of Companies for the needs of the Moscow Metro. In the Tashkent Metro the CBI-SM system is installed at 20 stations of two lines — the Sergeliyskaya line and the Circle Line.

DIGITAL AUTOMATED DISPATCH SYSTEM "DIALOG"

The computer-based dispatch interlocking "Dialog" system controls train traffic at the mainline railroads of different countries with the total length of 7000 km. In Moscow its modification for Metro was put into trail

operation on the Sokolnicheskaya line of the Moscow Metro and on the Sergeliyskaya and Circle lines of the Tashkent Metro where the digital interface is provided by the CBI-SM system.

The automated system for metro train traffic dispatch control "Dialog" takes the traffic dispatch control to a new level ensuring the possibility of optimum adjustment of the train schedule for fast return to the target indices. The adjusted schedule data can be used for further automatic metro train operation (ATO).

DIGITAL TRAM SIGNALING SYSTEMS

An important event happened in the history of the Moscow tram in 2021 — **the automated system for tram traffic integrated control** passed tests successfully and was certified for implementation on the Moscow tram lines.

In 2023 it was installed on 30 point machines and integrated into the single tram-car onboard system. The automated system for tram traffic integrated control is the basis of a digital ecosystem which will allow transfer to the remote tram control and to the driverless traffic afterwards.



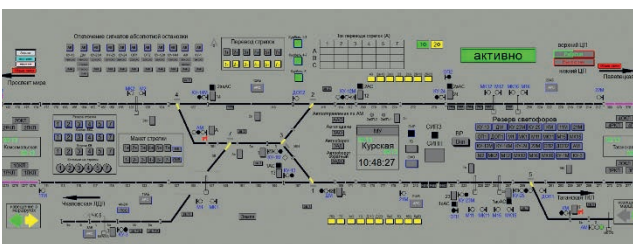
COMPUTER-BASED INTERLOCKING AND HYBRID systems for Metro: CBI-EL and HIS-EL

The long-standing partnership of the Signaling Division of 1520 Group of Companies with the Moscow Metro got to a new level when in April, 2021 CBI-EL was successfully commissioned in the electric depot “Sokol” (57 points) – the first computer-based interlocking system in the Metro of the Russian capital. In 2023 the CBI-EL systems were commissioned at all stations of the Moscow Metro Circle Line and in the Nizhegorodskoye electric depot of the Big Circle Line.

CBI FOR METRO: HIGHEST AVAILABILITY LEVEL

Uninterrupted train traffic with super-short train interval of the Moscow Metro is a safety factor itself under conditions of the intensive passenger traffic flow. Therefore, the CBI-EL architecture for metro is designed for ensuring the highest availability level by means of hot standby of all its components, including the object controllers. In case of the main object controller failure, the switchover to the redundant controller is carried out automatically. The redundancy is also

Mimic diagram of the station at the Local control and supervisory system (LCSS)



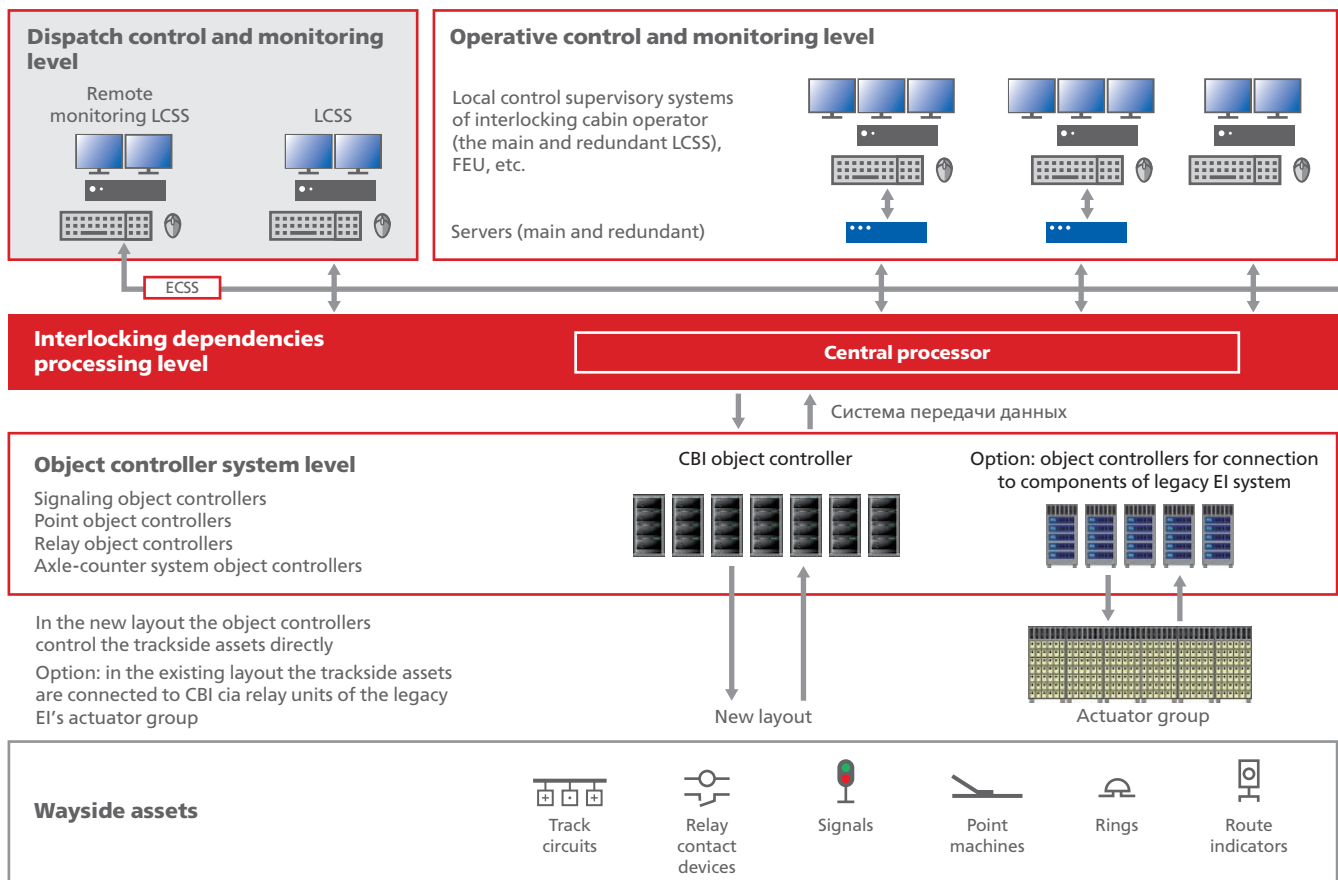
stipulated for the CBI-EL Central Processing Unit (CPU), all telecommunication equipment and local control and supervisory systems.

Due to the high dust pollution level in the Metro tunnels caused by the train traffic, the CBI-EL systems are equipped with the central processors with passive cooling systems for heavy-duty service.

Digital modules of track circuits control (DM- TCC) controlled via software interface are used as a traffic control subsystem in CBI-EL for the Moscow Metro. The operational logic of this subsystem is implemented by the central processor of CBI which demonstrates its advantages in terms of flexible configuring. The modules generate and transmit to track circuits the codes necessary for the onboard system of automatic locomotive signaling ARS-ALS.

The system ARS-ALS enables controlling the train traffic using short block sections into which the traditional automatic line block section fenced by signals is divided. In this case the train driver is guided by signal indications in the driving cabin, and the speed is limited automatically depending on the train situation.

The CBI-EL system is produced on the domestic hardware platform and supplemented with the enhanced cybersecurity system which comprises a cybersecurity monitoring device and a system network traffic analysis sensor. Such sensor detects any attempts of unauthorized connection to the system’s internal network.



ECSS enhanced cyber security system

Schematic diagram of the CBI-EL system with optional components of hybrid interlocking

The CBI-EL system for the Metro implements functions of adjustment and monitoring of the points' electric parameters and track circuits via Field Engineering Unit (FEU). This data is archived which enables prompt detection of malfunctions, and if required in emergencies, to make any necessary changes of the wayside devices' power supply parameters.

The CBI-EL architecture also allows creating the multi-station interlocking systems (such technical solution was implemented at the Moscow Metro Circle Line) and efficient integration with any adjacent relay systems using controllers connected via fibre optic line.

HYBRID SYSTEMS: EFFICIENT MIGRATION TO DIGITAL TECHNOLOGIES

The hybrid system HIS-EL allows modernizing the metro electric depots and stations without any train traffic interruption, enhancing reliability by means of the equipment redundancy. The system provides analysis and archiving of the train situation and driver activities data. Further on the full transfer to the computer-based technologies is possible without any additional investments. The combined version of the CBI and HIS systems is being implemented in the "Uzbekistan" electric depot with control from the unified LCSS.

COMPUTER-BASED INTERLOCKING

CBI-SM system for Metro

The computer-based interlocking CBI-SM system was developed specifically for the Metro by Stalenergo Ltd. — one of the Signaling Division entities. This modular system has extremely high-speed response, flexible architecture and can be easily adapted for the implementation object.

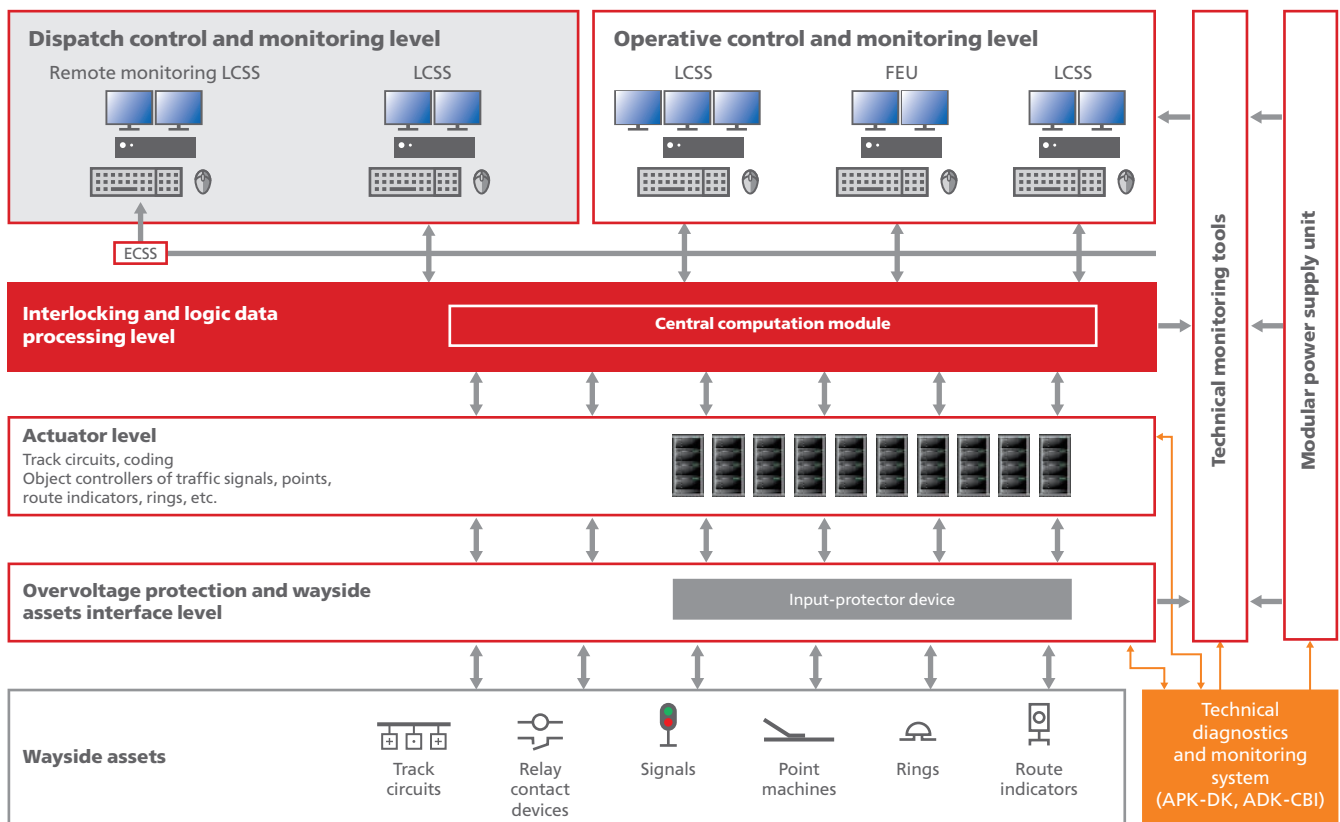
The computer-based interlocking system CBI-SM is designed for the inter-station metro line sections (with or without layout) and the electric depots both during new construction or upgrade of the train signaling devices. The CBI-SM system can be implemented in a few stages with gradual growth of its functionality.

HIGH-SPEED AND RELIABLE SYSTEM FOR METRO

The CBI-SM system meets the most tough requirements of the Metro with high intensity of traffic:

- capacity is at least 48 train pairs per hour;
- more than 1000 logical control objects (track circuits, points, signals, etc.);
- object controller data exchange cycle with provision of the detailed hardware and software diagnostics: no more than 0.15 sec;
- full data exchange cycle: no more than 0.45 sec;
- mean time between failures of CBI-SM (T0) is at least 50 thousand hours;
- 100% redundancy at all levels;
- protection from unauthorized access and erroneous command execution.

The CBI-SM system structure



ECSS enhanced cyber security system

THE CBI-SM ARCHITECTURE

CBI-SM consists of the following functional levels and subsystems:

- operative control and supervisory level with local control and supervisory systems of operators and technicians (LCSS, FEU, LCSS of signaling operators);
- interlocking and logical data processing level; where the central processing module is located;
- actuator level (track circuits, automatic speed control coding, object controllers);
- overvoltage protection and wayside assets interface level;
- CBI-SM components diagnostics and monitoring subsystem;
- uninterrupted power supply subsystem.

There is no option to use any dedicated computers in the central processing module functioning under operating systems. It is the first case in the world's practice when field-programmable gate arrays (FPGA) are used for implementing the logic of interdependencies of control and supervision objects which allowed eliminating any reliability and safety risks associated with computer hangs and unpredictable response of operation systems to emergencies, hacking and undocumented features. Connection to external devices is implemented via digital or relay interface.

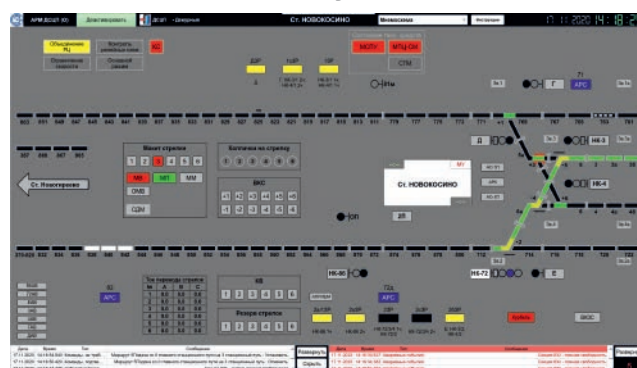
At the level of actuators (track circuits, ARS-coding, object controllers), qualitatively new safe circuits for digital generation and processing of control signals with self-diagnostic functions are used which eliminates any safety risks in case of semiconductor and relay elements failure.

An innovative component monitoring and diagnostics subsystem takes the CBI-SM system maintenance and operation to the qualitatively new level: event archiving, monitored parameters graphic visualization, easy-to-use interface with web-technologies.



CBI-SM controller boards

LCSS interface in the CBI-SM system



IMPLEMENTATION IN THE MOSCOW AND TASHKENT METRO

The CBI-SM computer-based interlocking system has been successfully tested in trial operation at the Novokosino station of the Moscow Metro.

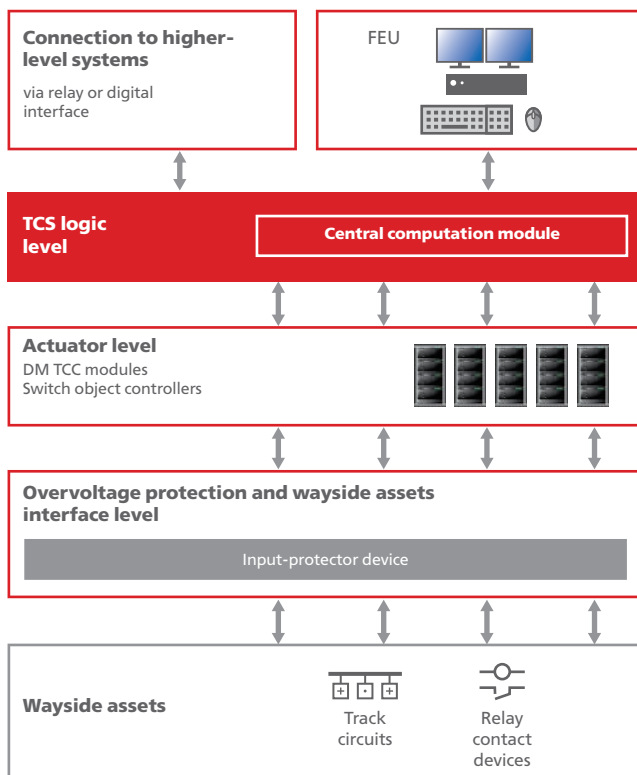
In the Tashkent Metro the CBI-SM system is installed at six stations of the Sergeliyskaya line opened in December, 2021. In addition, since 2022 the CBI-SM system has been deployed at 14 stations of the overground Circle Line in the multi-station modification: one CBI controls two stations. All stations are provided with digital communication via two fibre optic links. The digital interface is used for connection of CBI-SM with the computer-based dispatch system «Dialog».

COMPUTER-BASED TRAFFIC CONTROL SYSTEM

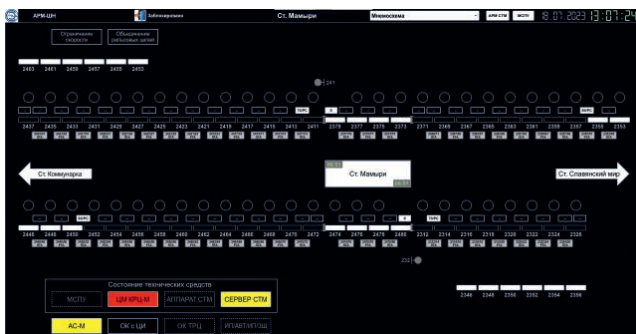
TCS

The digital computer-based traffic control system (TCS) based on the digital modules of track circuits control (DM-TCC) is an innovative development of Stalenergo Ltd. - one of the Signaling Division companies. The system ensures safety of the train traffic at open lines and stations equipped with the audio frequency track circuits with the centralized equipment layout.

The TCS with the audio frequency track circuits coded with ARS-ALS has been successfully implemented at 64 stations of the Moscow and Tashkent Metros where it has proved its high level of reliability and safety. Actually, this system is a standalone hardware-and-software solution, functions of which are focused on the traffic control both at individual stations and in the scale of the metro line.



TCS system structure



FEU interface in the TCS

MODULARITY AND CONFIGURABILITY

The TCS differs by a flexible modular structure and a wide range of configurability depending on the Metro needs:

- the main configuration of TCS stipulates inclusion of the central processing module into the system. It implements the interlocking logic, controls the DM-TCC modules and performs the system diagnostics at FEU, as well as connection to the higher-level computer-based, relay interlocking and automatic line block systems. This configuration is a ready solution with the maximum speed of response to be transferred to the CBI-SM system in the future without any change of the TCS equipment, if implemented in conjunction with electric interlocking (EI) systems. The train control system in this configuration is implemented at the Big Circle Line of the Moscow Metro;
- integrated configuration of the TCS where the traffic control logic is provided by the software of the upstream CBI central processor with the connected DM-TCC modules. This solution allows building TCS into the existing CBI systems irrespective of its manufacturer. Such a modification of the TCS is implemented at the Circle Line of the Moscow Metro.

When implementing TCS within a modernization or a new construction project it is possible to connect it with relay automation systems at the first stage which can be gradually transformed into computer-based systems with the minimum investments. In order to achieve that, it is sufficient to remove the relay equipment, add the CBI-SM object controllers and update software in the logic and visualization cores at LCSS.

FUNCTIONS OF THE INTEGRATED TCS

Alongside with the basic functions, such as track section vacancy and trackway integrity monitoring, transmission of data about the state of the track circuit to the upper-level control systems via digital or relay interface, generation and transmission of ARS signals to the track circuit, the integrated TCS carries out:

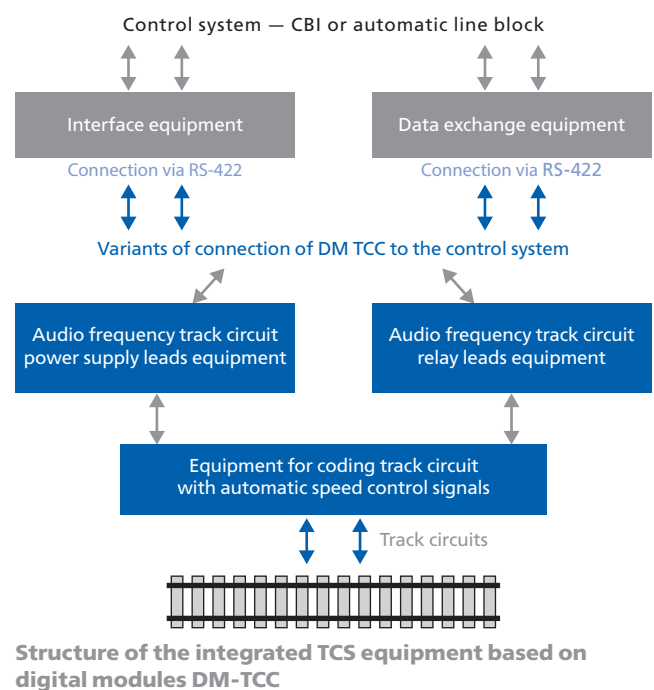
- automatic self-diagnostics with data transmission to the diagnostic center;
- surge overvoltage protection with logging of the number of operations;
- cable core cross connection;
- distribution of audio frequency track circuit power supply through a modular combined power supply unit (MCPSU) via power supply routes.

ADVANTAGES OF TCS BASED ON DM-TCC

- Enhanced reliability and availability due to electronic equipment redundancy, data link duplication and automatic data link fall back.
- Enhanced safety ensured by two-processor schematic configuration of devices with strong links.
- Integrated diagnostic tools.
- Integratability with relay and computer-based metro signaling systems.
- Resistance to lightning and surge overvoltages.
- Protection against power voltage failures and interruptions.
- Reducing the number of relays by means of digital connection to control systems via RS-422 or Ethernet interfaces.
- High ready-to-use level.

EXTREMELY HIGH SPEED RESPONSE

In January, 2023 during inspection of automation system at the Circle Line of the Moscow Metro the TCS based on DM-TCC modules in conjunction with CBI-EL provided the



capacity of 45 trains per hour in each direction. The train interval amounted to 80 s – it is the best index among all the Metros in the world.

AUTOMATED SYSTEM FOR METRO TRAIN TRAFFIC DISPATCH CONTROL “Dialog”

Efficient automated dispatch control of train traffic in the Metro and other mass transit systems is critical for maintaining uninterrupted transportation process and minimizing consequences of traffic failures in case of emergencies.

The automated system for metro train traffic dispatch control “Dialog” of the Signaling Division of 1520 Group of Companies is built on the basis of the computer-based dispatch system “Dialog” which is operated successfully on the lines with the total length of over 7000 km in Russia, Belarus, Kazakhstan, Uzbekistan and Latvia. This system is installed, in particular, at the Moscow suburban railroads with high train traffic intensity.

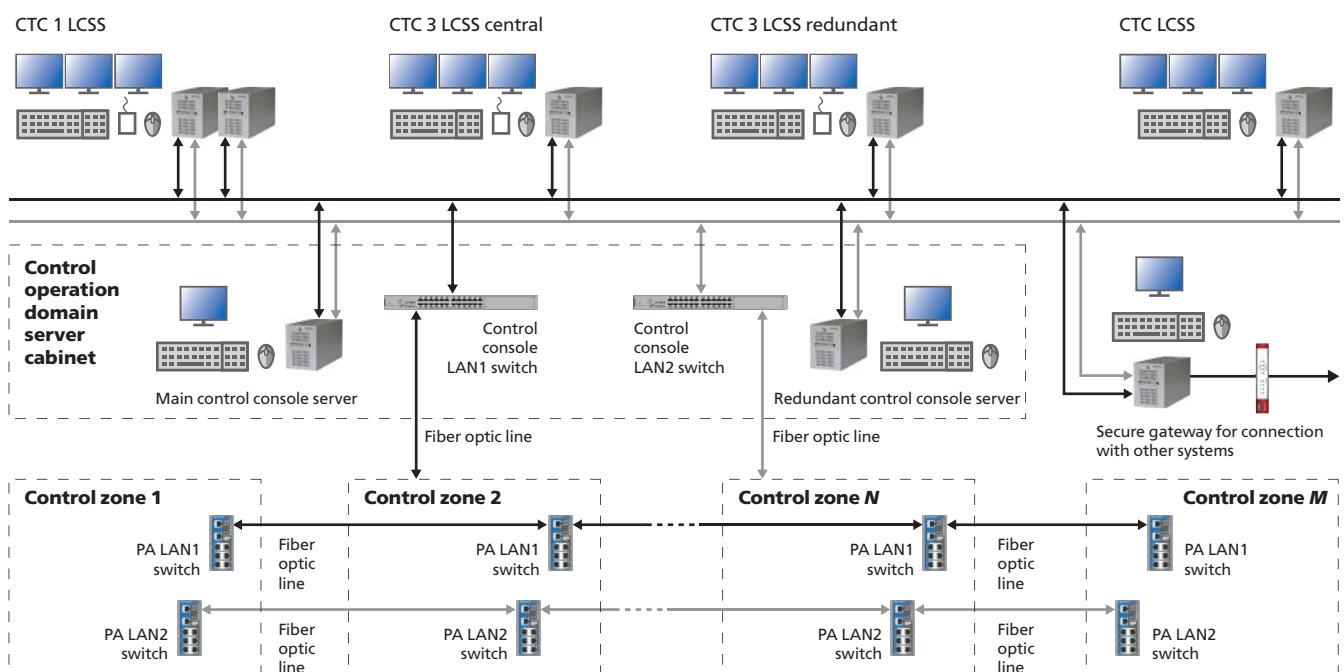
The automated system for metro train traffic dispatch control “Dialog” is deployed at the Sergeliyskaya and Circle lines of the Tashkent Metro where the CBI-SM systems are connected to it. In the Moscow Metro within the scope of experimental service the automated system

for metro train traffic dispatch control “Dialog” provides dispatch control of the Troparevo station equipped with the CBI-EL system and dispatch control of all stations on the Sokolnicheskaya line. The CBI-SM and CBI-EL systems are linked to the automated system for metro train traffic dispatch control “Dialog” via a digital network. The implementation of the system in the Moscow tram depot is being prepared.

HIGH SAFETY AND RELIABILITY PERFORMANCE

Functional safety of the system complies with the tough requirements of the Metro and the railroad transport. To enhance reliability, only industrial-profile equipment is used in the system, and all main components are made redundant. All critical hardware and software tools were developed by “Dialog-trans” Company and its Russian partners.

Structure of the automated system for metro train traffic dispatch control “Dialog”



Special attention was paid to information security of the automated system for metro train traffic dispatch control “Dialog” — special measures have been implemented for protection of the transmitted telegrams against tampering and diddling. There are also used the integrated protection tools, FSTEC-certified operation systems and inter-network screens.

HIGH FUNCTIONALITY

The automated system for metro train traffic dispatch control “Dialog” is in exact accordance with the functional requirements applied to such systems in the general development concept adopted by the Moscow Metro.

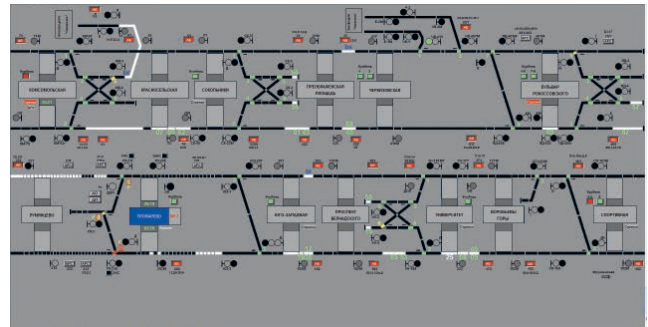
Alongside with the basic functions of monitoring and control of the station objects and displaying the scheduled, forecast and performed train schedules, the system acquires data of the station and onboard equipment condition which will allow taking timely measures of dispatch control if pre-failure occurs, prevent from the train traffic failures and transfer to the condition-based maintenance.

The automated system for metro train traffic dispatch control “Dialog” is capable of mutual connection and data exchange with any higher-level and lower-level systems, including other dispatch control systems, various CBI types, RBTC, SCADA systems, etc.

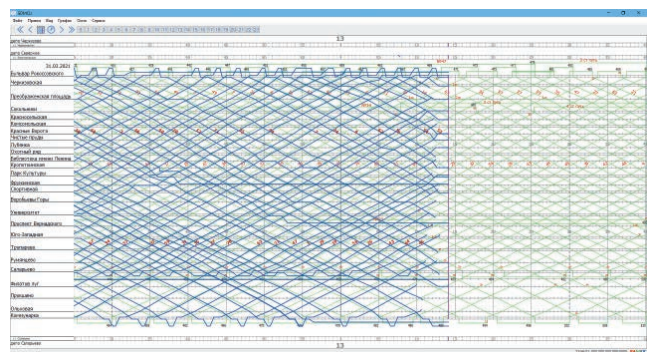
EFFICIENT INVESTMENT PROTECTION

Flexible and up-to-date architecture of the automated system for metro train traffic dispatch control “Dialog” ensures efficient scalability and possibility of further automation upgrade with implementation of new functions which will be highly desired in the future.

It allows the customer to easily protect investments in its implementation and upgrade the system functionality in accordance with the requirements.



A fragment of the mimic diagram of the Sokolnicheskaya line



Train schedule display

ADVANTAGES OF THE AUTOMATED SYSTEM FOR METRO TRAIN TRAFFIC DISPATCH CONTROL “DIALOG”

- Enhancing the train schedule performance by means of extending information, monitoring and diagnostic functions.
- High operational efficiency and labour comfort for the dispatch personnel.
- Up-to-date, convenient and easy-to-use interface.
- Reduction of operating costs due to the use of reliable equipment, process optimization and equipment power consumption reducing.
- Implementation of “Advisor” and “Automatic Dispatcher” modes.
- Compatibility with any station-level systems (relay, hybrid and computer-based types).
- Intelligent performed traffic schedule with functions of its best adjustment forecasting in case of any deviation from the planned schedule.
- Unlimited number of control and monitoring objects.
- High functional and information security.

MODULAR COMBINED POWER SUPPLY UNIT

MCPSU

Stalenergo Ltd. which is one of the Signaling Division companies has been implementing modular combined power supply units (MCPSU) at the Moscow and Tashkent Metro stations since August, 2018. They provide reliable uninterrupted power supply of the computer-based and relay signaling devices. Modular design of such units facilitates its configuration for the conditions of a specific implementation object.

MCPSU ADVANTAGES

- Automatic or manual switch of the load from one feeder to another in case of power failure or overvoltage, incorrect phase sequence or open-phase fault in an operating feeder.
- Uninterrupted power supply of the signaling objects' loads.
- Electric isolation from the signaling object consumers' power front ends.
- Protection against lightning and surge overvoltages on input circuits of external AC sources.
- Automatic monitoring of insulation resistance decrease in power supply circuits of the signaling objects' loads.

MCPSU cabinets of Stalenergo Ltd



- Compatibility with any grounding system.
- Operation in equal feeders mode or with priority of feeder 1 or feeder 2.
- Measuring values of voltage and current in feeder phases, voltage in load power supply circuits and current in battery circuits using switchboard instruments.
- Emergency shutdown of external power supply sources and batteries from the signaling objects' loads.
- Light alarm of the condition of feeders, units, circuit breakers, reduction of electric resistance in one of the monitored circuits.
- Remote alarm of the MCPSU devices condition using potential-free contacts and Ethernet.
- Real-time display and archiving the MCPSU devices condition at MCPSU LCSS and upper-level LCSS.

HARDWARE VERSIONS

Stalenergo Company supplies the Metro with modular combined power supply units of two types: MCPSU-20-03-M EI for relay devices up to 20 kVA and MCPSU-40-02-MD for computer-based signaling devices up to 40 kVA. MCPSU-40-02-MD has several modifications for different voltages of the input 3-phase current source — 3×220 V and 3×380 V.

The mean time between failures of MCPSU amounts to at least 40 thousand hours, the service life is at least 25 years. The independent power supply time of the relay or computer-based signaling devices is at least 1 hour.

By 2023 midyear the MCPSU units were implemented at 64 stations of the Moscow and Tashkent Metros. Over the past operation years MCPSU proved its highest reliability level, providing power supply and protection of the relay and computer-based signaling equipment.



DIGITAL SYSTEMS FOR TRAFFIC CONTROL ON THE Moscow Metro Circle Line

The Signaling Division has implemented a unique project of the signaling systems complete upgrade on the Moscow Metro Circle Line. Some of them have operated for nearly 70 years without any train traffic interruption.

Office and process rooms of the Metro were used for deployment of the computer-based equipment because the existing relay devices had to function before the launch of the new systems. The 1520 Group professionals had to carry out a vast scope of works in these premises: probing and other activities for diverting the ground water, upgrading air conditioning, fire extinguishing, communication and power supply systems.

The works in the tunnels were carried out during night train traffic interruptions. Then the connection diagram for 295 track circuits was upgraded completely at open lines and stations.

At the final stage in early January, 2023 the Circle Line was operated in one direction only — first counter-clockwise, then clockwise. In those days the professionals were connecting the wayside assets to the digital traffic control systems. Six CBI-EL systems have been implemented on the Circle Line, each controlling two stations and being connected to the dispatch control system. Now 36 train pairs transit along the Circle Line instead of the previous 34 ones.

FEU, the CBI-EL equipment cabinets and TCS at the Paveletskaya station after implementation of the digital systems



The track indicator with track layout mimic, operating console and relay equipment which were operated at the Paveletskaya station since 1954



AUTOMATED SYSTEM FOR TRAM TRAFFIC

integrated control



New tram lines are built and the existing tram lines are upgraded in the Russian cities actively. In order to be operated efficiently and safely, the lower-level control signaling systems are necessary with subsequent integration of the tram into the unified mass transit control ecosystem.

In cooperation with the mass transit enterprises of the biggest Russian megapolises, the Signaling Division has developed and implements the automated system for tram traffic integrated control. This system uses a radio channel to control the point machines from the tram driver cabin and monitors its position which allows increasing its passing speed and the tram line capacity.

COMPONENTS OF THE AUTOMATED SYSTEM FOR TRAM TRAFFIC INTEGRATED CONTROL

- Innovative point machine in different modifications for any operation conditions.
- Tram automation control cabinet in different modifications, including one with integrated point operating gear heating system.
- Low-voltage heating control cabinet.
- Signals indicator of the point machine position.
- Radio-based tram traffic control system.
- Radioelectronic tram identification system.

The first automated system for tram traffic integrated control was commissioned for permanent operation at more than 30 point machines in Moscow, the onboard devices are adapted and integrated into the single onboard tram-car system, including the most widespread tram-car model in Russia: "Vityaz".

AUTOMATED SYSTEM FOR TRAM TRAFFIC INTEGRATED CONTROL FUNCTIONALITY

- Point machine position monitoring and locking.
- Remote transmission of information about the point machine to the driver using a light indicator installed above the point or located in the driver cabin on the information screen on the onboard control and monitoring module.
- Remote control of the point machine based on the radio channel from the driver cabin.
- Automatic point operation according to the route of the approaching tram.

When the system is implemented, the existing aerial contacts and its functionality can be preserved. Once the whole tram-car fleet is equipped with the onboard automated systems for tram traffic integrated control, the aerial contacts can be removed.

The system implementation is accompanied by the upgrade of the existing solenoid point machines with their additional equipping with the position monitoring sensors or installation of the new electromagnetic drives with reference rulers and self-restoration after splitting a point.

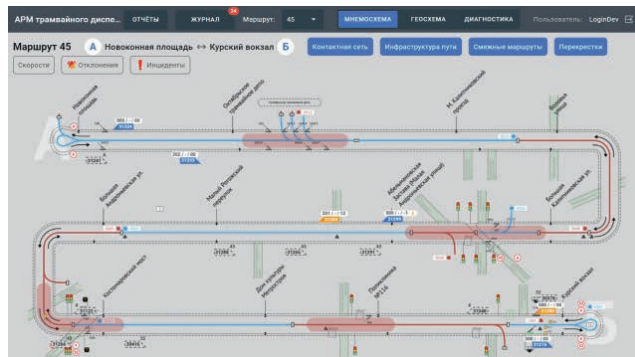
The onboard equipment of the automated system for tram traffic integrated control includes the control and monitoring module, controller with the route base, a set of antennas and identifying label reader. The wireless data exchange between the onboard system and the tram traffic control cabinet is carried out at

citizen's radio communication frequencies using a secure cryptographic protocol.

THE AUTOMATED SYSTEM FOR TRAM TRAFFIC INTEGRATED CONTROL IS A KEY ELEMENT OF DIGITAL ECOSYSTEM

Equipping the whole rolling stock fleet with the automated system for tram traffic integrated control provides the wide range of options available for the unified dispatch centre also. The dispatcher can not only visually monitor the current tram position in the map, but also adjust the route, receive information about operation of the wayside infrastructure objects and tram-cars via LTE radio communication network, including the data of the current speed, mileage, tram-car occupancy and even the driver's state.

When the high-speed communication with the unified dispatch center is deployed, the automated system for tram traffic integrated control will allow transfer to the remote tram-car control and to the driverless traffic further on.

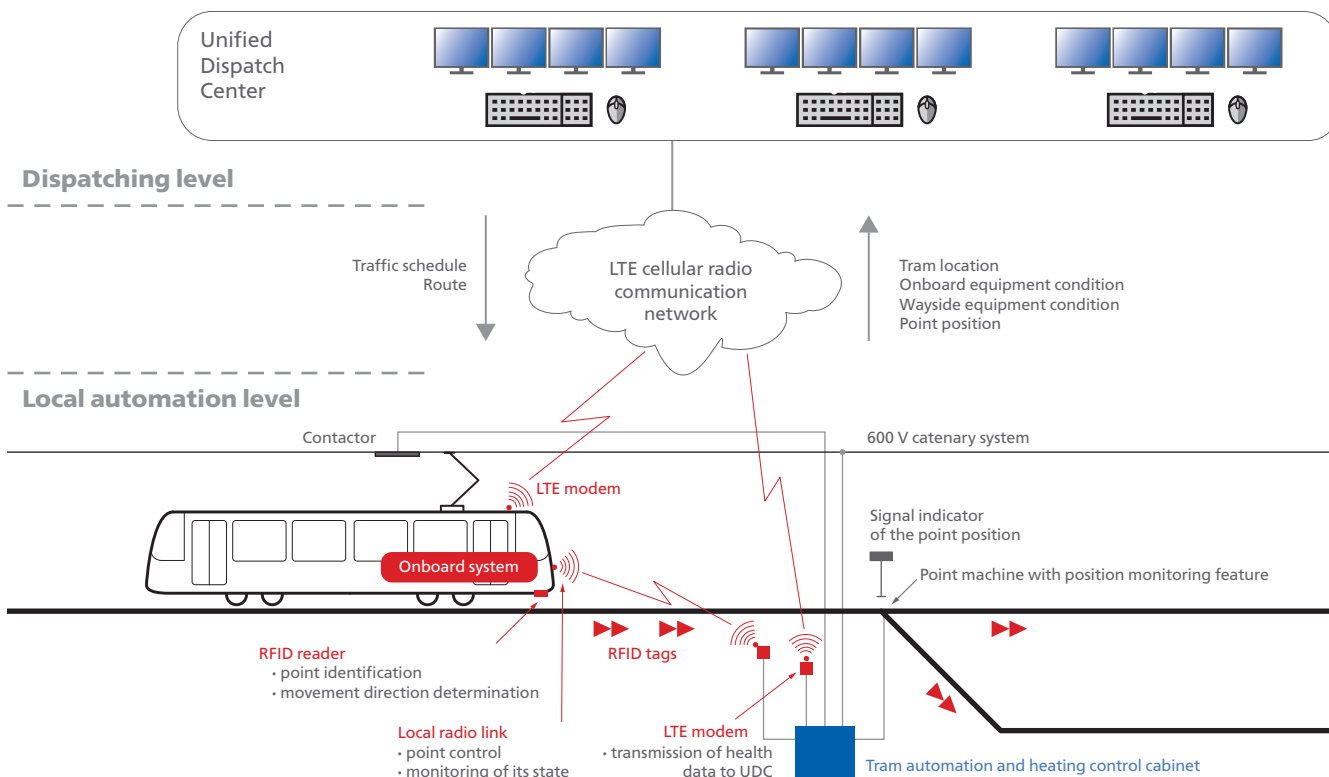


LCSS of the tram operator



Onboard control and monitoring module with a touch screen

Functions and main components of the automated system for tram traffic integrated control



DIGITAL COMMUNICATION AND WARNING SYSTEMS

for mass transit

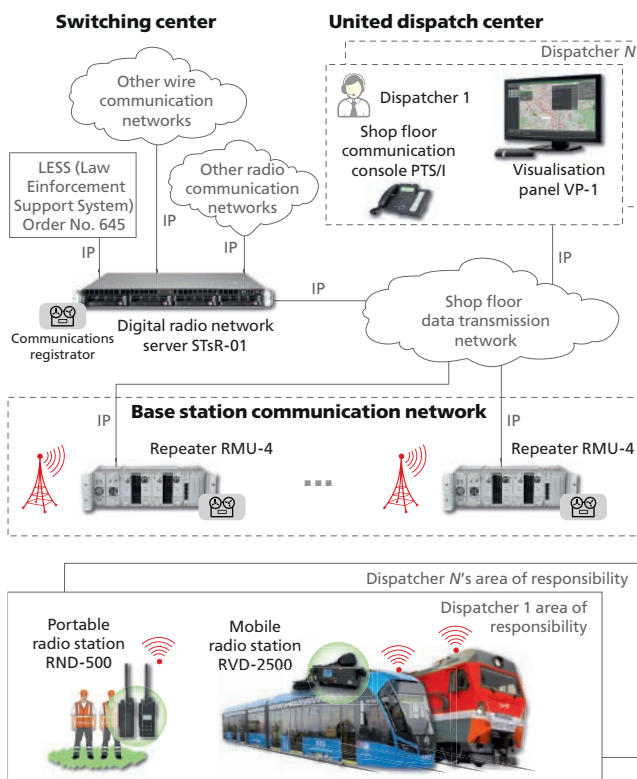
The 1520 Group Signaling Division supplies the digital communication, dispatch communication, loudspeaker and master clock systems.

DMR DIGITAL COMMUNICATION SYSTEM

The up-to-date professional mobile radio communication system of DMR standard allows arranging a secure technological radio communication network which provides:

- individual, group and emergency calls, call prioritization;
- text message transmission;
- noise-free data transmission for control and information systems;
- centralized voice communication logging;
- subscriber location and movement speed monitoring on the basis of GLONASS and GPS data;

DMR mobile radio communication system architecture



- possibility of simultaneous operation in analog and digital mode;
- equipment condition remote monitoring.

IP-ATC DISPATCH COMMUNICATION SYSTEM

IP-ATC on the "Sura" platform is a versatile solution for arranging a scalable network of industrial communication with a set of optional services, as well as dispatch telecommunication. It is a fully domestic development with high information security level.

DOUBLE-WAY FLEET COMMUNICATION AND LOUDSPEAKER WARNING EQUIPMENT

The Double-Way Fleet Communication and Loudspeaker Warning Equipment SDPS-MDE is based on the modularity approach and ensures high flexibility and scalability for implementation of configurations of various complexity. Managers of different levels use it to get remote access to any alert zones.

The system based on UMK-4 amplifiers provides loudspeaker communication, automatic personnel alert in security systems, transmission of messages for passengers and displaying text information on electronic boards.

MASTER CLOCK SYSTEM

Master clock system is designed to support a unified synchronized precise time network at the transportation facilities with the possibility of the equipment and data complete redundancy. The precise time is displayed on the electronic and analog clock/board.

THE SIGNALING DIVISION OF THE 1520 GROUP OF COMPANIES

A leading provider of the integrated technical solutions in the field of traffic control and safety for all types of rail transport — mainline railways, high-speed lines, mass transit and industrial transport.



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>4000
employees



Assets

8
enterprises



Geography

30
countries



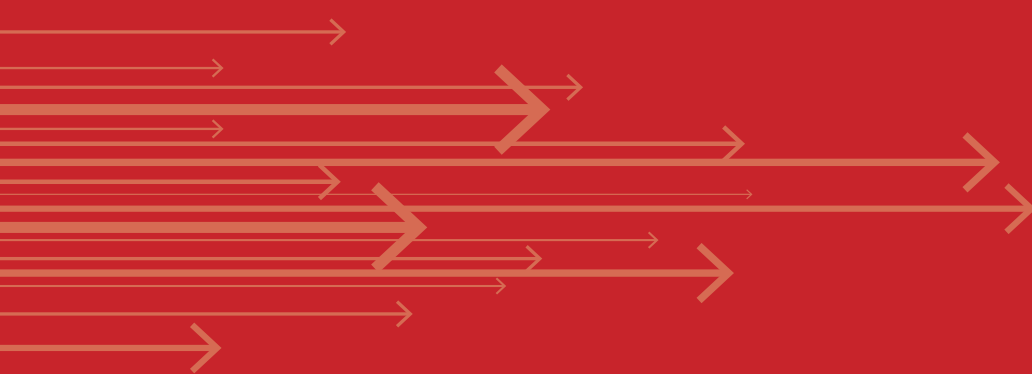
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