



SMART  
SYSTEMS



## TRAFFIC CONTROL

Digital Rail  
Transport Systems



**TMH Smart Systems**

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€3.4  
bn

revenue of TMH in 2022.

100,000+  
employees

in group companies.

**TMH is Russia's leading producer of mobility solutions.** Group companies are actively developing in 1520 track gauge area, Africa, and Latin America. We supply passenger trains and railcars, subway trains, locomotives, engines, and components to railway operators and manufacturers in more than 30 countries.

# One System, One Offer

TMH Smart Systems (TMH SS) offers customers integrated solutions for smooth and safe rail traffic.

TMH SS includes 4 companies: **AVP Technology, Transtelesoft, LES, and Research Institute of Technology, Monitoring and Diagnostics of Railway Transport.**

Their expertise is the design, production, and service of digital systems and technology for rail traffic control.



Competence center and laboratory for machine vision in mechanical engineering.



Two research laboratories for customization and testing of signaling systems.



LocoTech-Signal Asia Competence Center and signaling system production site in the Republic of Kazakhstan.

# Portfolio

## INFRASTRUCTURE SOLUTIONS (SIGNALING SYSTEMS)

TMH SS offers customers a wide range of modern high-tech wayside equipment for traffic control – signaling & interlocking devices.

Our systems are based on both Russian designs and joint solutions created with the involvement of international companies.

Signaling systems make railways the safest form of transport. You don't even have to wear a seatbelt, unlike cars and aeroplanes.

### Our Solutions

- Computer-based system of traffic control at stations and sections between stations.
- Track circuits.
- Wireless point switch.
- Automated system of integrated tram traffic control.

## ROLLING STOCK SOLUTIONS (ON-BOARD EQUIPMENT)

To keep the lead in traffic control, TMH SS is developing high-tech on-board systems based on data communication technology and trainable neural networks. Such equipment reduces the involvement of humans in traffic control, requires significantly less wayside infrastructure and offers cost benefits for rolling stock operators.

### Our Solutions

- Machine vision-based systems.
- On-board safety systems.
- Virtual coupling.
- Automatic train operation.
- Video monitoring system when train runs in reverse.
- Remote locomotive control system.

**We create safe solutions for all types of rail transport: urban (subways and trams), mainline, and industrial.**

## MONITORING AND DIAGNOSTICS TECHNOLOGY

Modern diagnostic technology quickly and accurately identifies problems in the operation of locomotive systems and prevents possible breakdowns and accidents. Such technology includes machine vision, vibration monitoring, pressure monitoring, temperature monitoring, and other parameters of critical locomotive parts as well as systems to analyze the data and transmit it to make a prompt decision. This improves machine reliability and operating efficiency and reduces repair times.

### Our Solutions

- On-board predictive diagnostics system.
- Infrastructure diagnostics.
- Stationary diagnostics system.

## UNMANNED TECHNOLOGY AND INTEGRATED SOLUTIONS

We expect rail transport to become fully unmanned in the foreseeable future.

To achieve technological advancement in this direction, TMH SS develops integrated solutions for rail transport automation, which integrate existing products into a single concise solution with wide functional capabilities and guaranteed level of safety with minimal human involvement.

### Our Solutions

- Unmanned subway.
- Automatic train driver.

# Mainline Transport Solutions

## Infrastructure Solutions (Signaling Systems)

- CTRL@LOCK400 Computer-Based Interlocking.
- CTRL@SIGNAL Computer-Based Block Signaling.
- CTRL@TRACK 100 Track Circuits.

## Rolling Stock Solutions (On-Board Equipment)

- CTRL@DRIVE Automatic Train Driving.
- CTRL@CONNECT Virtual Coupling.
- CTRL@SAFE On-Board Safety System.
- Bort R On-Board Safety System.

## Monitoring and Diagnostics Technology

- CTRL@MAINTENANCE On-Board Predictive Diagnostics System.
- Stationary Diagnostics Systems.



# Industrial Transport Solutions

## Infrastructure Solutions (Signaling Systems)

- CTRL@LOCK 200, CTRL@SBLOCK 200 Computer-Based Interlocking.
- CTRL@TRACK 100 Track Circuits.
- CTRL@POINT Wireless Point Switch.

## Rolling Stock Solutions (On-Board Equipment)

- CTRL@VISION 50 Collision Blocking System.
- CTRL@VISION 100 Obstacle Detection System.
- CTRL@VISION WE Video Monitoring System When Train Runs in Reverse.
- CTRL@REMOTE Remote Locomotive Control System.

## Monitoring and Diagnostics Technology

- CTRL@MAINTENANCE On-Board Predictive Diagnostics System.
- Stationary Diagnostics Systems.

## Unmanned Technology and Integrated Solutions

- Automatic train driver.



# Subway Solutions

## Infrastructure Solutions (Signaling Systems)

- CTRL@LOCK 100 Computer-Based Interlocking.
- CTRL@TRACK 50, CTRL@TRACK 100 CM Track Circuits.

## Monitoring and Diagnostics Technology

- Infrastructure diagnostics.

## Unmanned Technology and Integrated Solutions

- CTRL@TRAFFIC Unmanned Subway.

# Tram Solutions

## Infrastructure Solutions (Signaling Systems)

- CTRL@TRAM 100 Tram Point Switch Control.
- CTRL@TRAM 200 Tramway Depot Automation.
- CTRL@TRAM 300 Tram Line Automation.





Infrastructure  
Solutions



CTRL@LOCK 100

# Computer-Based Interlocking

The system is designed to control subway train traffic. It is a completely Russian design that is compatible with existing wayside infrastructure.

40 train  
pairs per hour

## Benefits

- System functions meet subway operation regulations of Russia and CIS.
- 100% hot standby of all system components.
- High reliability, flexibility, and scalability.
- Unified compact modular hardware and software platform.
- Continuous logging of train situation and device operation parameters.

## Effects

- High speed: calculation cycle time does not exceed 100 ms.
- Maximum system availability, reliability, and fault tolerance.
- Less workload on operating personnel.
- Automation of routine operations.
- Non-contact control without the use of external relays.

CTRL@LOCK 200

# Computer-Based Interlocking

The system is designed to control industrial and shunting rolling stock traffic. TMH SS has a research laboratory for customization.

## Benefits

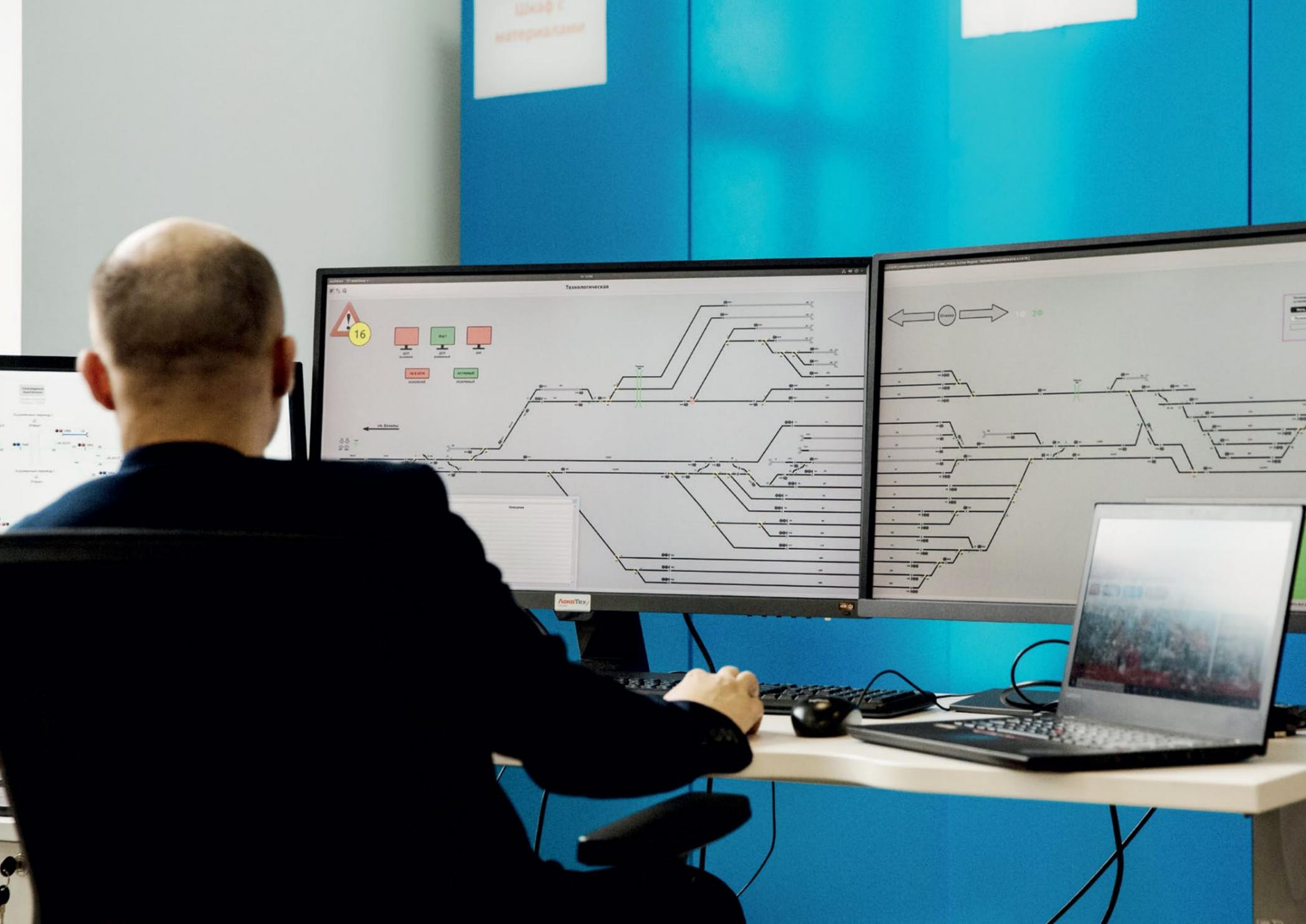
- Ability to adapt the system to any track section.
- Management of railway infrastructure of any complexity.
- Up to 20% less spending on operation and maintenance.
- All components are commercially available.
- Easy to commission, configure and maintain.
- SIL3 safety level.

## Effects

- High availability due to redundant supervisory computer control system architecture.
- Up to 50% less technological space.
- Ability to build a spatially distributed control system.
- Continuous monitoring of operating personnel actions.
- Expanded diagnostics and WEB interface.



MINIMUM RISK  
OF SYSTEM FAILURES  
AND TRAIN DELAYS



CTRL@LOCK 200

# Computer-Based Interlocking

The system controls train traffic on industrial lines using fiber optic communication cables.

## Benefits

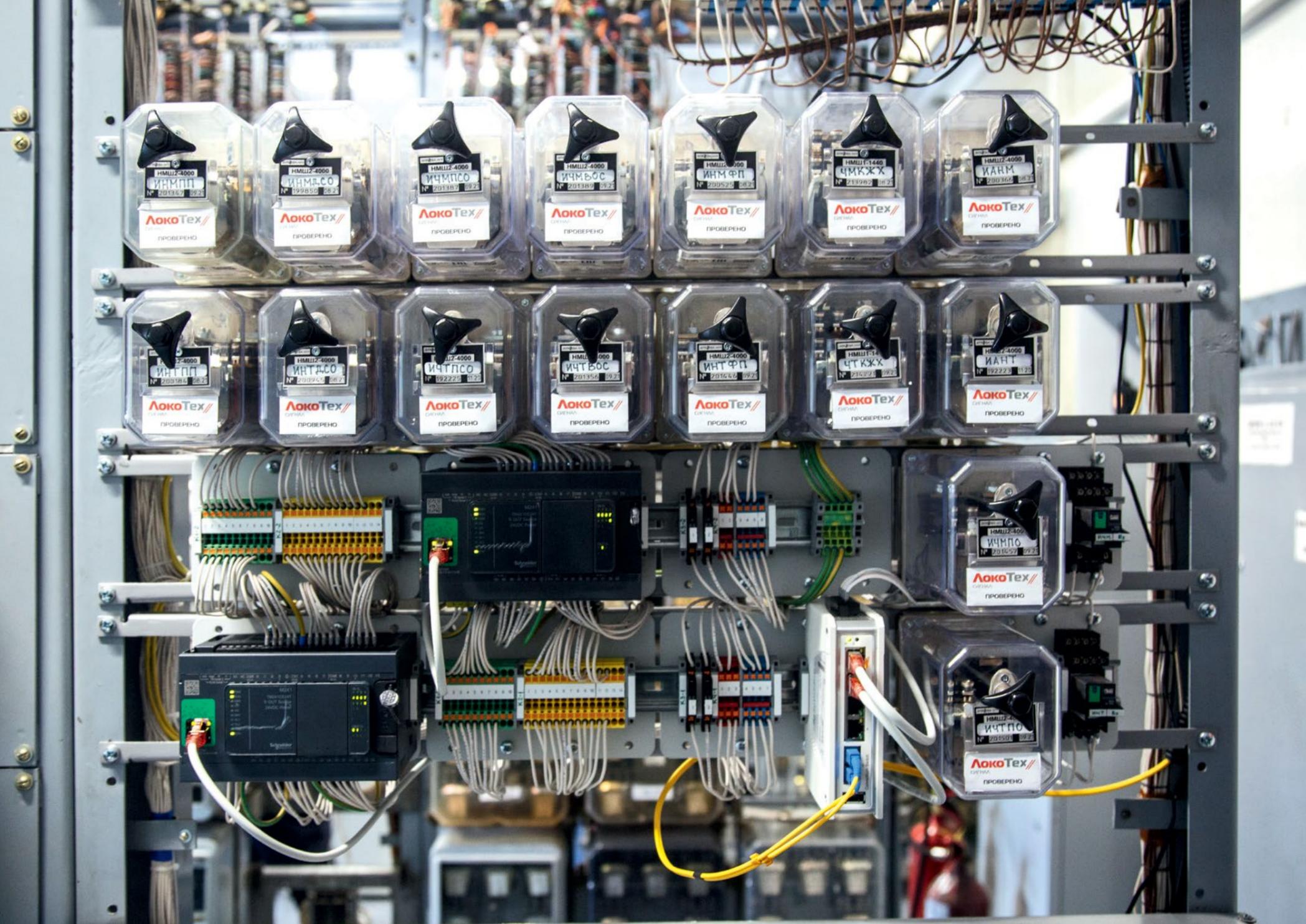
- Fast adaptation to customer requirements and standards.
- The system can be deployed on sections of any length.
- Improved reliability by using FOCL cabling instead of straight cable.
- Constant technical support from the manufacturer.

## Effects

- Optimized CAPEX: less equipment and spending on it.
- Optimized OPEX: less spending on copper cable maintenance.
- Safer due to avoidance of copper cable thefts.
- Continuous monitoring of operating personnel actions.
- Avoidance of unauthorized interference with the system logic.



A SINGLE SYSTEM  
FOR SEVERAL SECTIONS  
BETWEEN STATIONS



CTRL@LOCK 400

# Computer-Based Interlocking

The system is designed to control mainline rolling stock traffic. In order to customize the system, LocoTech-Signal-Asia (part of TMH SS) has a research laboratory and a production site in the Republic of Kazakhstan.

## Benefits

- Ability to adapt the system to any track section.
- Management of railway infrastructure of any complexity, including HSLs.
- New generation computing systems.
- Non-contact control.
- Expanded operating temperature range: -40/+85 °C.
- Easy to commission, configure, and maintain.
- SIL4 safety level.

## Effects

- High availability due to redundant supervisory computer control system architecture.
- Up to 50% less technological space.
- Ability to build a spatially distributed control system.
- Continuous monitoring of operating personnel actions.
- Expanded diagnostics and WEB interface.



MINIMUM RISK  
OF SYSTEM FAILURES  
AND TRAIN DELAYS





CTRL@SIGNAL

# Computer-Based Block Signaling

**The system is based on CTRL@LOCK 400 CBI and CTRL@TRACK 100 track circuits and is an effective means of rail traffic management system on mainlines.**

## Benefits

- Higher reliability and lower OPEX due to the use of microprocessor hardware components.
- Easy to maintain due to the combined track circuit controller.
- Built-in diagnostics detect the pre-failure state of all system components.
- Deployable in the form of conventional automatic block signaling with light signals or without light signals (ALS cab signalling).

## Effects

- Higher throughput capacity of station-to-station sections.
- Maximum cost benefit is achieved by integrating automatic block signaling into CBI.
- Savings in equipment range and available inventory.
- Less technological space.

# Track Circuits

The system is designed to monitor track section vacancy/occupancy, detect rail breakage, and code track circuits by ALS-ARS signals in subways.



## CTRL@TRACK 50

### Benefits

- 100% hot standby of devices without stopping train traffic.
- Continuous health check of system components.
- Logging of all system operation and display on the local service workstation and/or transmission to higher-level systems.
- Operated in St. Petersburg and Moscow subways.

### Effects

- Less spending on maintenance.
- High availability, no traffic delays.
- Compact design – two new devices in hot standby are installed instead of one old device.

The system is designed to monitor track section vacancy/occupancy, detect rail breakage, and code track circuits by ALS cab signalling (ALS-ARS codes for subways).

## CTRL@TRACK 100

### Benefits

- Designed and certified for the entire 1520 track gauge area, including the Baltics.
- Ability to switch to condition-based maintenance.
- Integrated: audio frequency track circuits + coding.
- High reliability and 100% hot standby of modules.
- System self-diagnostics and operation logging.

### Effects

- Minimum risk of emergencies.
- Less spending on maintenance.
- High availability.



2 OPTIONS FOR INTERFACING  
WITH RAIL TRAFFIC  
MANAGEMENT SYSTEMS – RELAY  
AND DIGITAL

# CTRL@POINT Wireless Point Switch

The system is designed to automate the control of hand point switches in shunting zones, locomotive depots, non-centralized station zones of industrial railways.

Up to 20%  
less wayside  
equipment

Up to 20%  
less spending  
on operation

## Benefits

- One-click point control.
- Point switch position monitoring.
- Occupancy monitoring to prevent switching under rolling stock.
- Less time for point switching and route preparation: up to 30 minutes per route.
- Operating temperature range: -60/+65 °C.
- Information exchange between equipment in the range of 868.7–869.2 MHz.
- Ability to control the point from a handheld tablet.
- Two versions: point machine and track box; sleeper motor with control equipment.

## Effects

- Ability to drive the locomotive without an assistant.
- Protection against damage to motor internals in case of point trailing.
- Collection and transmission of additional diagnostic data on motor parameters.
- Minimum operational errors.





CTRL@TRAM 100

# Tram Point Switch Control

**The system is designed to control tram point switches in automatic mode. The driver no longer has to be distracted from the traffic situation and no longer has to get out on the track to manually switch the point. Now they'll do it remotely from the driver's cab.**

## Benefits

- 100% Russian design.
- Radio control via on-board control module.
- Electrically heated point.
- Smooth and silent operation.
- Additional point position monitoring.
- Possible phased implementation of the system both in existing infrastructure and on tracks under construction.

## Effects

- High availability.
- Higher tram line capacity.
- Less spending on tram infrastructure maintenance.
- Expanded diagnostic capabilities.
- Minimum operating errors: the system rules out point switching under the tram.

CTRL@TRAM 200

# Tramway Depot Automation

The system is designed to control depot operations. It controls the tram schedule, automatically controls the rolling stock without a driver, logs personnel actions, diagnoses and indicates malfunctions.

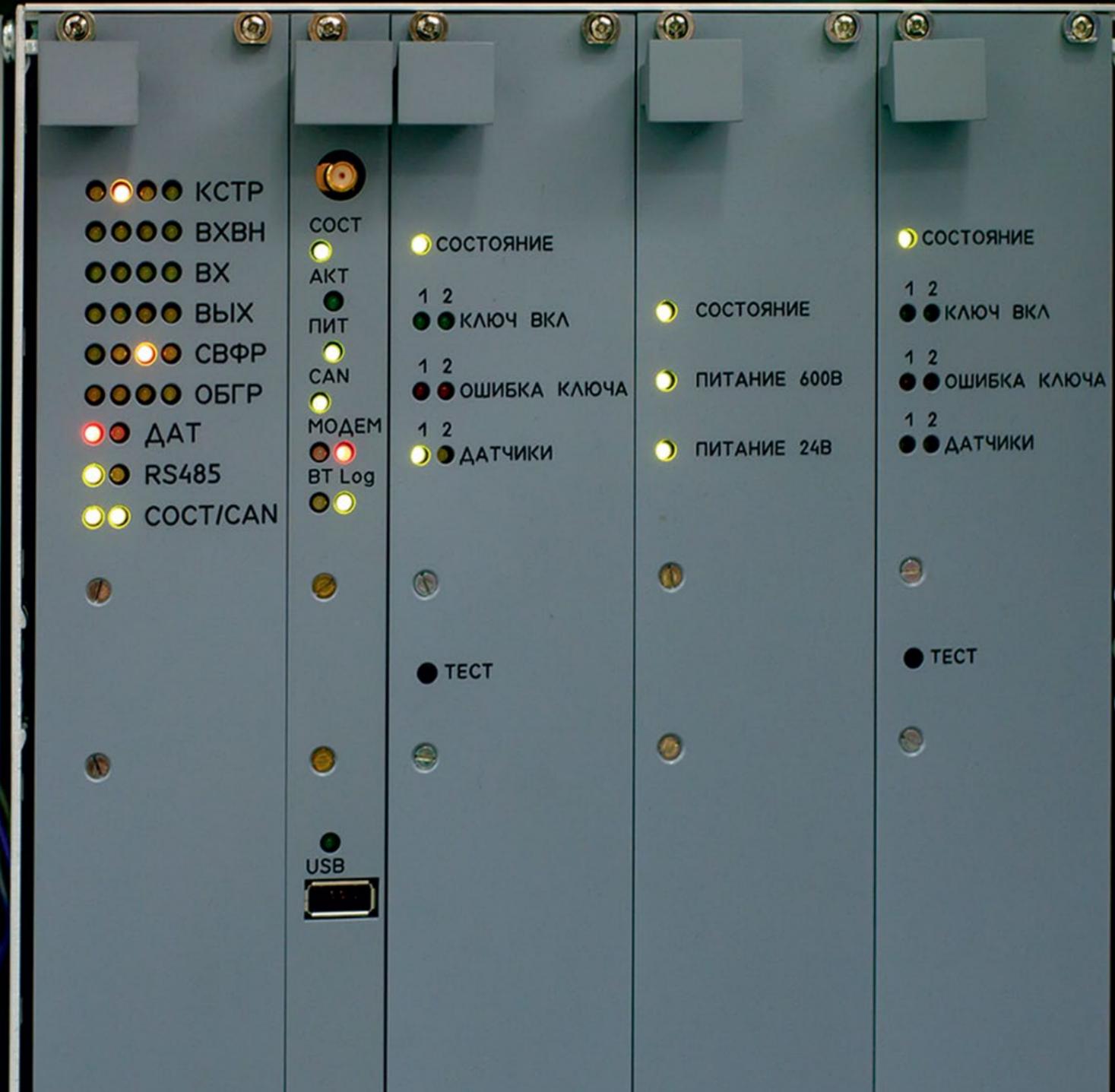
The system automatically arranges rolling stock for overnight stopping and leaving the depot.

## Benefits

- 100% Russian design.
- Packaged supply of the entire tram automation system, i.e., a single center of responsibility to the customer.
- Application of state-of-the-art, field-proven engineering solutions.
- SIL3 safety level.

## Effects

- Safety improvement by avoiding human error.
- Less time for shunting operations, putting the rolling stock on standstill, and putting it on the line.
- Energy savings due to optimized shunting and driving operations.
- Fewer manual operations of personnel.
- Full monitoring and traceability of document flow.





CTRL@TRAM 300

# Tram Line Automation

**The system displays the current traffic situation in the depot and on the line (single control center). It also does automated passenger counting and passenger traffic analysis as well as automatic point switching along a given route.**

## Benefits

- 100% Russian design.
- Packaged supply of the entire tramway automation system.
- Application of state-of-the-art, field-proven engineering solutions.
- SIL3 safety level.

## Effects

- Safety improvement by avoiding human error.
- Less time for shunting operations, putting the rolling stock on standstill, and putting it on the line.
- Energy savings due to optimized shunting and driving operations.
- Fewer manual operations of personnel.
- Full monitoring and traceability of document flow.

# Rolling Stock Solutions



CTRL@VISION 50

# Collision Blocking System

The system is designed to prevent rolling stock from colliding with people or obstacles. It is based on cameras and machine vision algorithms to see an obstacle on the way and quickly block the collision.

## Benefits

- High obstacle detection accuracy.
- Image display with overlaid analytics in the driver's cabin.
- When there is a person or obstacle in the way, the system will signal and block the collision.
- Automatic switching to sensors according to the selected direction of movement.

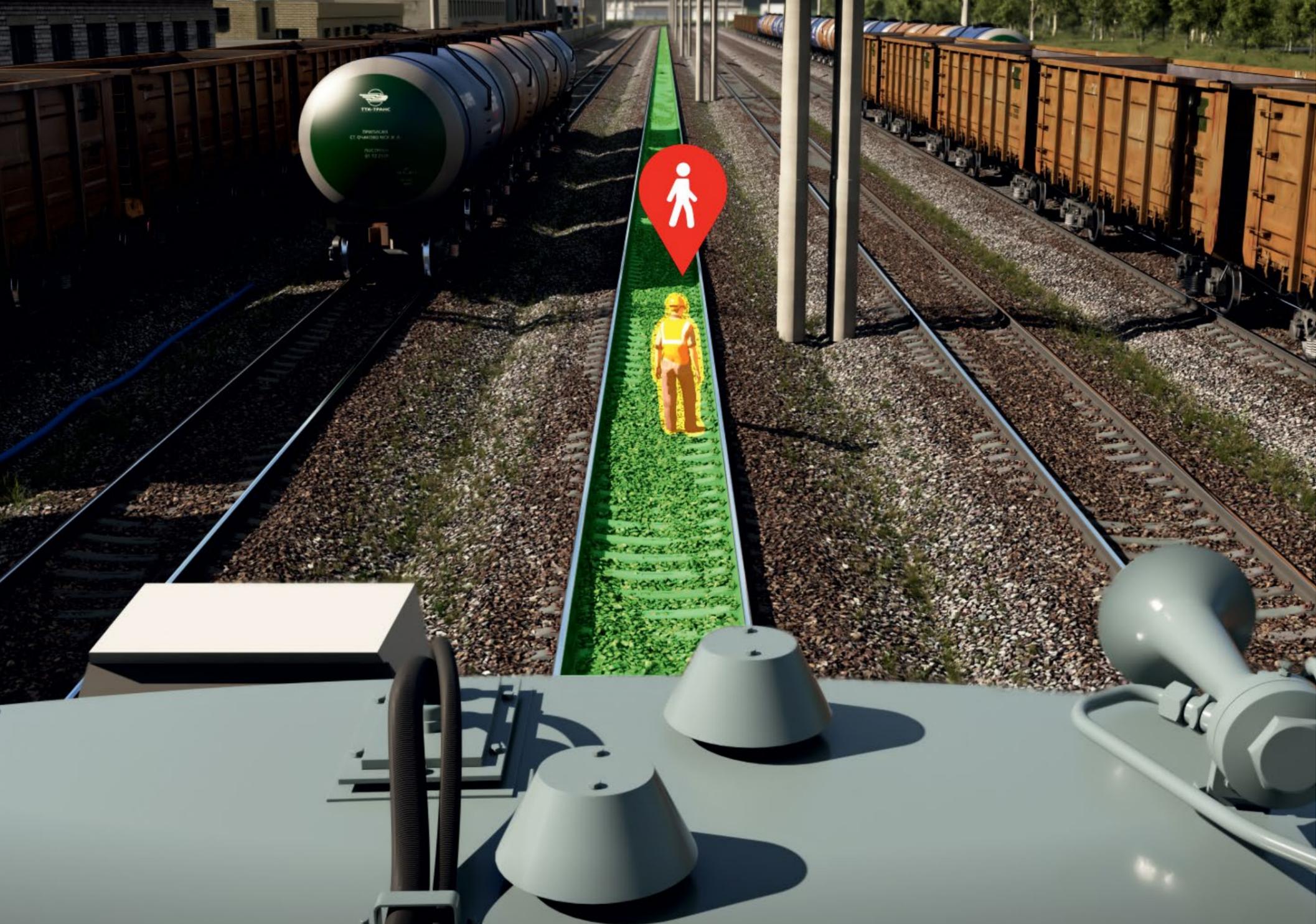
## Effects

- Lower injury rate due to blind spot monitoring.
- Prevention of safety violations.
- Ability to operate at any time of day in all weather conditions.



IT WILL DETECT A PERSON  
IN ANY POSITION





CTRL@VISION 100

# Obstacle Detection System

The system prevents the rolling stock from colliding with various objects, determines the distance to obstacles, monitors the position of points, signal aspects, and draws the driver's attention.

## Benefits

- High speed and quality of data analysis.
- System versatility for any locomotive.
- Ability to operate at any time of day in all weather conditions.
- Customization.
- Automatic switching to sensors according to the selected direction of movement.

## Effects

- Improved traffic safety.
- Less idle time and unscheduled repairs of rolling stock.



CTRL@VISION 100 WE

# Video Monitoring System When Train Runs in Reverse

**The system provides visibility when the train is traveling forward by installing a mobile video control unit on the tail carriage and transmits the image to the driver's screen.**

## Benefits

- Ability to connect to the camera in real time for multiple users at the same time.
- Ability to operate under vibration and shock loads.
- Easy to install, configure, and maintain (no fasteners required).
- No additional carriage equipment required.
- No additional personnel skills required.
- Customized system power options.

## Effects

- Improved traffic safety.
- No yard conductor is required on the footplate of the last carriage.
- Less spending on locomotive crews.
- Parktronic effect when approaching an obstacle.



**IT CAN HANDLE COMPLEX TRACK PROFILES AND GRADIENTS OF UP TO 40%**

A person wearing a high-visibility yellow and black safety vest is holding a rugged, orange-handled handheld tablet. The tablet screen displays a 3D simulation of a railway yard with tracks, buildings, and a blue highlighted path. The person's hands are visible, one holding the handle and the other near the screen. The background is a blurred outdoor setting with greenery and a paved area.

CTRL@REMOTE

# Remote Locomotive Control System

The system is designed for remote control of a locomotive or a group of locomotives from a portable or stationary console without a driver.

## Benefits

- Remote control of traction, braking, reverse, diesel, horn, sand supply.
- Visualization of telemetry and obstacles on the console or operator/controller screen.
- Ability to switch between locomotives equipped with the system.
- Visualization of the exact position of the locomotive on the station mnemonic.
- Visualization of diagnostic data on the condition of locomotive systems.

## Effects

- Less spending on locomotive crews.
- Improved occupational safety of yard conductors.
- Minimization of time spent by operating personnel on railway tracks.
- Additional functions as required by the customer.

CTRL@SAFE

# On-Board Safety System

**The system prevents accidents and collisions on mainline and industrial railways, improves safety and efficiency of transport. The speed is continuously monitored during operation and, if exceeded, train-stop braking may be applied.**

The system ensures non-stop movement of locomotives when passing the boundaries of railway sections equipped with various types of rail traffic management systems.

## Benefits

- Built-in diagnostics of ALS cab signalling.
- Own decoding workstation capable of analyzing track circuit signals.
- Own map editor capable of converting maps from other systems.
- Trip data backup.

## Effects

- Avoidance of unauthorized passage of a stop aspect.
- Avoidance of unauthorized locomotive movement (rolling).
- Driver vigilance monitoring.



**TOUCHSCREEN  
INTERFACE CONTROL**



# Bort R On-Board Safety System

**A new integrated traffic safety system being designed by Transtelesoft together with Research and Design Institute of Informatization, Automation and Communication of Railway Transport on the basis of Bort and BLOCK-M systems for the Russian Railways to be used on TMH rolling stock. The system is designed to prevent accidents and collisions on mainline and industrial railways, improves safety and efficiency of transport. The speed is continuously monitored during operation and, if exceeded, train-stop braking may be applied.**

## Benefits

- Improved reliability by reducing the number of processor modules and using higher performance processors.
- Interface of subsystems via Ethernet.
- Touchscreen interface control.

## Effects

- Avoiding unauthorized entry to an occupied block section.
- Avoidance of unauthorized locomotive movement (rolling).
- Driver vigilance monitoring.



# CTRL@CONNECT Virtual Coupling

**The system is designed to control several freight trains via radio channel in fully automated mode. Continuous data exchange ensures energy-optimal train operation and safety.**

## Benefits

- Automatic operation of up to 5 trains.
- Up to 8 km range of confident radio data exchange.
- Transmission of telemetry data to the information systems of Russian Railways.

## Effects

- Improved traffic safety.
- Up to 15% higher throughput on existing infrastructure.
- Possible interval between freight trains from 7 minutes.
- Up to 20% less locomotive fleet turnover.





CTRL@DRIVE

# Automatic Train Driving

The system is designed to control traction and all types of train braking based on the track profile, speed limits and schedule. The technology improves energy-saving parameters and improves the safety of mainline and industrial transport.

## Benefits

- Automatic traction and braking control, including regenerative braking.
- Self-diagnostic function.
- Different driving modes: according to schedule, according to station-to-station travel time, in advisor mode, according to virtual coupling.

## Effects

- Up to 8% less fuel and energy consumption.
- Up to 1 minute accuracy of scheduled traffic.
- Compliance with standard rolling stock operating modes.
- Improved traffic safety.



ABILITY TO DRIVE  
THE LOCOMOTIVE  
WITHOUT AN ASSISTANT

# Monitoring and Diagnostics Technology



CTRL@MAINTENANCE

# On-Board Predictive Diagnostics System

**The system is designed to collect and transmit data on the technical condition of rolling stock in order to predict the failure of critical components. It will improve the reliability of equipment, reduce the number of failures and unscheduled repairs, and switch to condition-based maintenance of locomotives in the future.**

## Benefits

- Ability to integrate with existing locomotive systems.
- Transmission of data on ground via wireless communication channels in automatic mode.
- Functional expansion capability.
- Use of domestic components.

## Effects

- Improved locomotive reliability.
- Fewer failures and unscheduled repairs.
- Cost savings.
- Switching to condition-based maintenance of locomotives.



# Infrastructure Diagnostics

**The system is designed for monitoring and diagnostics of subway infrastructure. Special machine vision algorithms visualize and instantiate the detected defect with kilometer, reference peg, time, and location.**

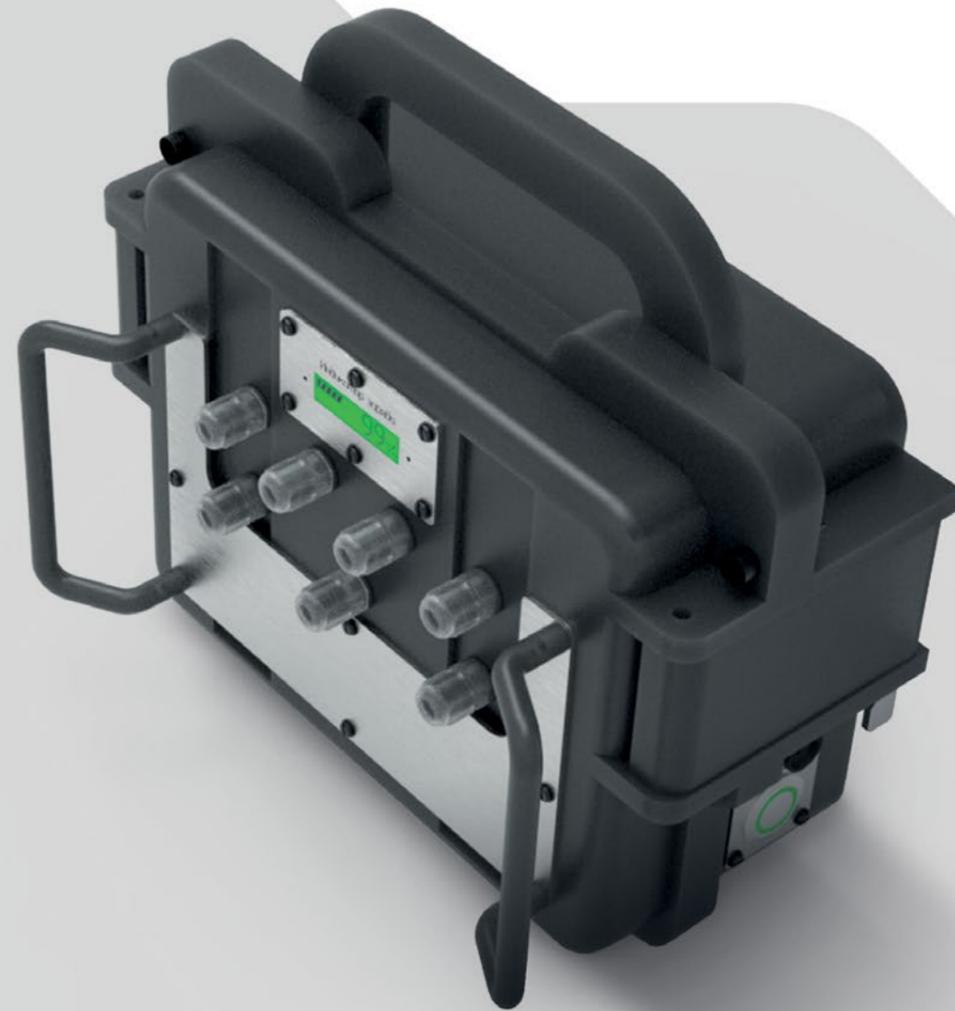
## Benefits

- Real-time transmission of diagnostic data to the controller.
- Communication of the diagnostics system with subway services.
- Assessment of parameters inaccessible to humans without special equipment.
- System scalability.
- Long-term storage of data on the server.
- 24/7 system operation.

## Effects

- Up to 50% less maintenance personnel.
- Avoidance of human error.
- Single-minded approach to infrastructure assessment.





## PROGNOZ PRO Real-Time Diagnostics System

**The system is designed to assess the technical condition of rotating machines by measuring and analyzing vibration parameters in time and frequency domains. It is used in systems of diagnostics and monitoring of technical condition of rotor equipment of transport and industry.**

### Benefits

- Determination and classification of technical condition of components based on the analysis of their vibration state.
- Synchronous and simultaneous data acquisition from all channels.
- Diagnosis time of one wheels and motors unit – up to 40 s.
- Forecast estimation of permissible vibration state and effective period of equipment operation.
- High reliability of results, automatic decision making.

### Effects

- Less time spent due to rapid diagnostics and automation of reports.
- Improved reliability through synchronized data acquisition, falsification protection and decision support.
- Improved safety due to galvanic isolation between the diagnostician and the object being diagnosed.

Unmanned  
Technology  
and Integrated  
Solutions



# CTRL@TRAFFIC Unmanned Subway

The system is designed for unmanned traffic in subways and allows adapting work flow to the train situation, station utilization rate and emergency situations.

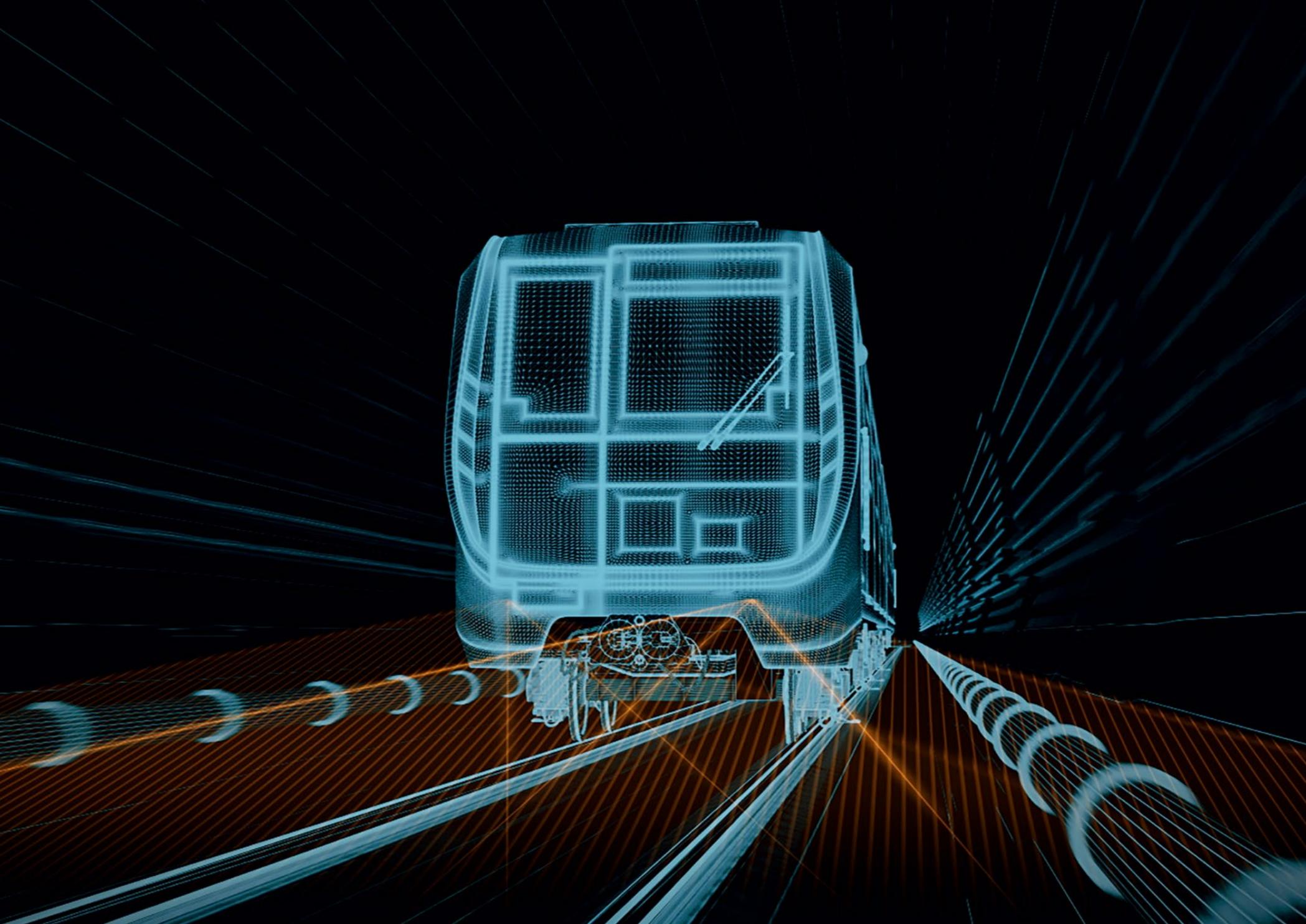
100%  
Russian design

## Benefits

- Full compatibility with wayside infrastructure and rolling stock.
- Predictive diagnostics of rolling stock.
- Application on lines of various configurations and lengths.
- Built-in operation planning and analysis tools.
- Integrated solution including stationary and on-board automation, control, diagnostics and monitoring facilities, train traffic control.

## Effects

- Avoidance of human error.
- Energy savings of up to 15%.
- Guaranteed train traffic on schedule.
- Less rolling stock downtime.
- Better operating personnel working conditions.





CTRL@TRAFFIC 200

# Shunting Automation System (Automatic Train Driver)

**An integrated solution that automates the majority of shunting processes at large stations and industrial facilities.**

## Benefits

- Adaptation for any type of shunting and hauling locomotives.
- Minimization of operating personnel.
- Wide functionality at a reduced cost.
- Russian design.
- Integrated solution including safety functions, obstacle detection and automatic train operation.

## Effects

- Risk of human error reduced to zero.
- Substantial optimization of operating personnel.
- SIL4 safety level.
- Up to 10% less spending on fuel and energy.