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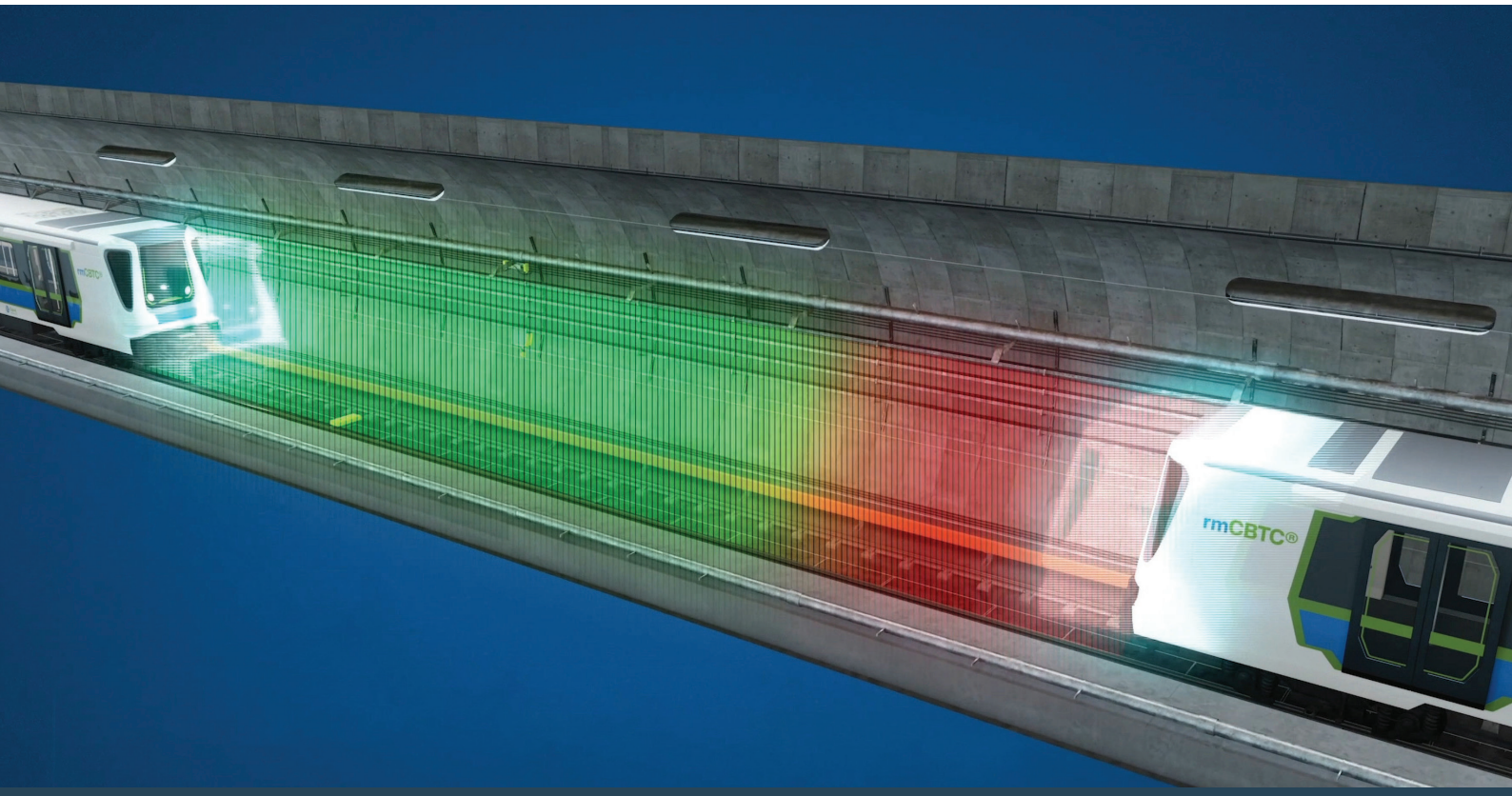
rmCBTC® System



CBTC class automatic train control system
designed to meet the requirements
of the ERTMS/ ETCS.

Full integration with
Q7 - mRailProtector4.0®

**Technology customized
to client's needs.**

The rmCBTC® automatic train control system has been developed in a close partnership with the Warsaw University of Technology Faculty of Transport and it has been co-financed by the National Centre for Research and Development, as part of the European Union Operational Programme Smart Growth.

Project number:	**POIR.01.01.01-00-0276/17**
Project title:	CBTC class automatic train control system, based on unique bi-directional wireless data transmission and interoperational ETCS components, which increases efficiency and safety level in the agglomeration rail transport.
Project objective:	Increasing the level of efficiency and safety of the public rail transport.
Beneficiary:	Rail-Mil Computers sp. z o.o.

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rmCBTC® - System Overview

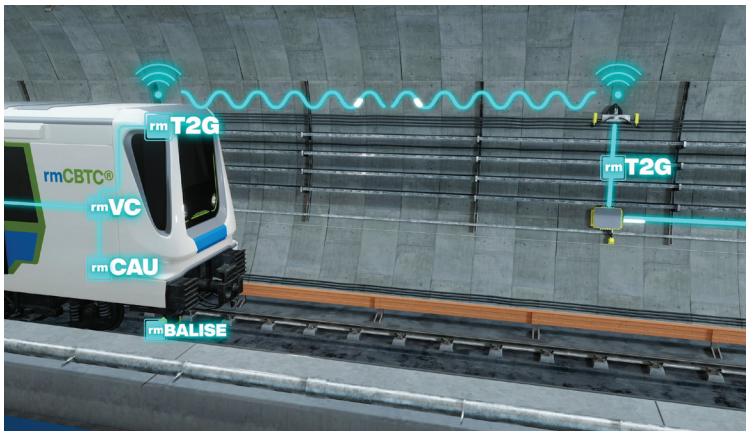
An automatic train control system rmCBTC® is a fundamental traffic control system that has been designed to meet the demands of various applications, such as urban rail (i.e. metro, light rail, commuter rail, etc.), dedicated train lines, and shunting yards.

The rmCBTC® is a CBTC (Communication-Based Train Control) class system and uses a bi-directional, wireless, train-to-ground data transmission between the infrastructure and the rolling stock to control trains. As the purpose of this system is to increase the efficiency and safety of the railway, the safety principles and hardware platform were based on the interoperable ERTMS/ETCS system. From a standpoint of both functionality and hardware, the system architecture is divided into:

- rmCBTCs – a trackside sub-system, including interfaces for the systems existing in an infrastructure;
- rmCBTCp – an on-board sub-system, including interfaces for the systems existing in trains.

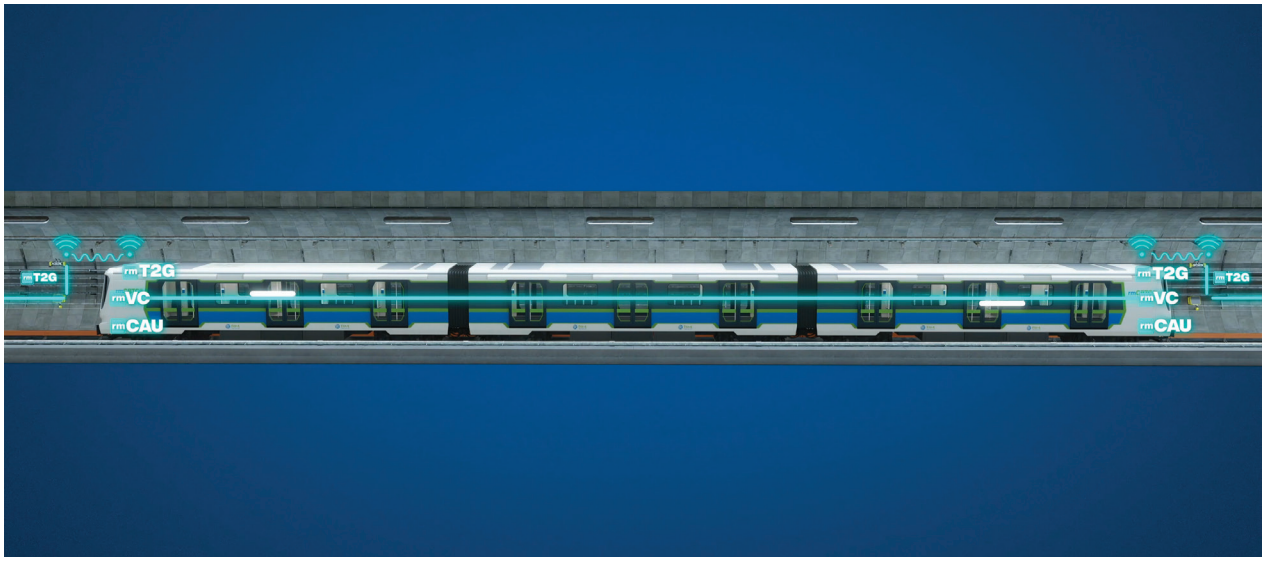
The system can be implemented either in an extended rmCBTC+ or a basic version according to customer's requests and specifics of a given installation. The extended version allows guiding the mixed train traffic thanks to the information from the stationary devices.

The stationary rmCBTCs sub-system communicates with the rmCBTCp sub-system installed on trains via bi-directional, wireless data transmission (WiFi / LTE / TETRA / etc.).

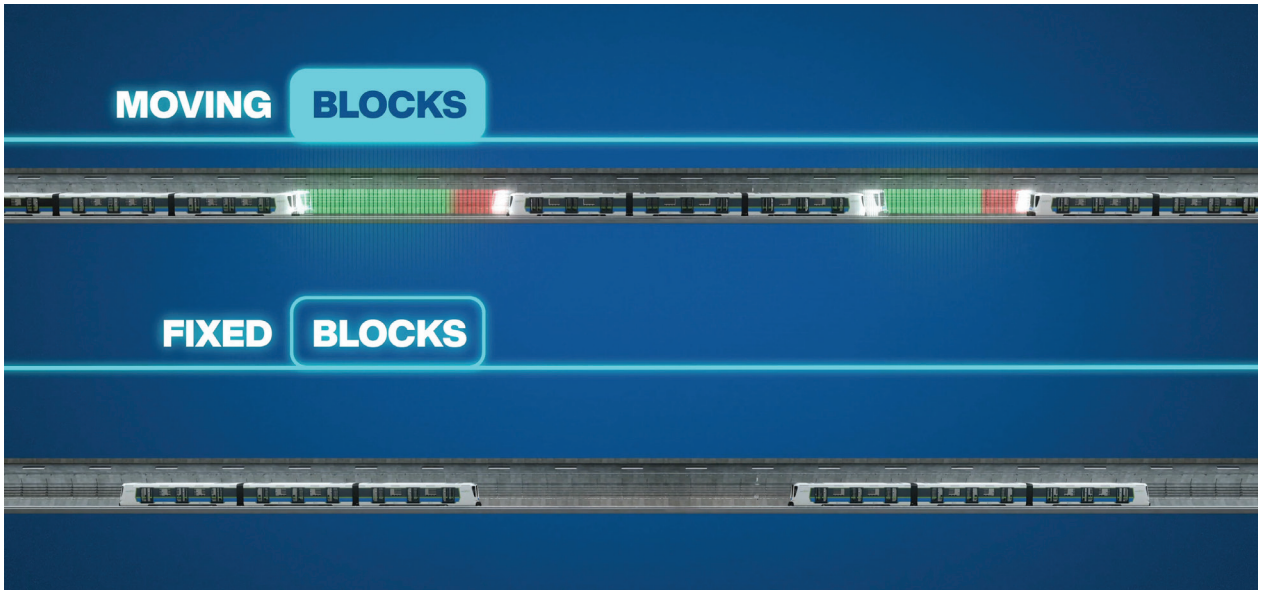


Communication between the on-board and the trackside architecture of the rmCBTC® system.

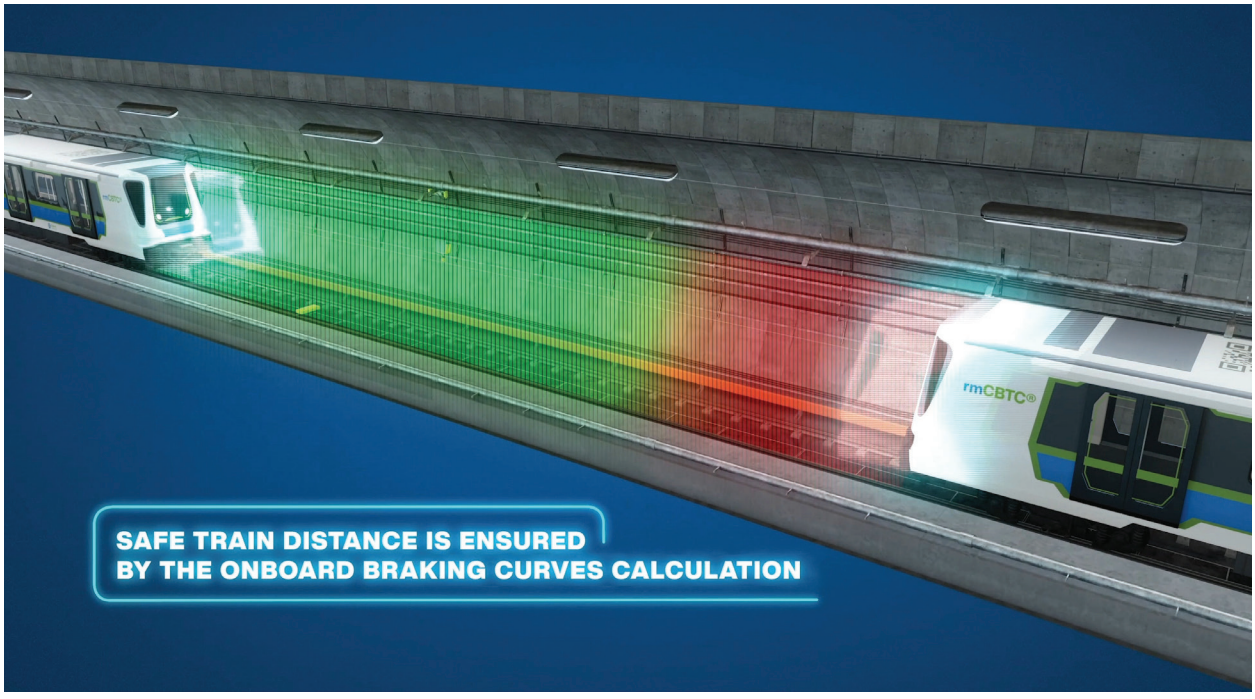
The modular and scalable architecture of the on-board sub-system features a symmetrical set of equipment for both driver cabins in order to uphold a constant transmission between the devices within the vehicle.



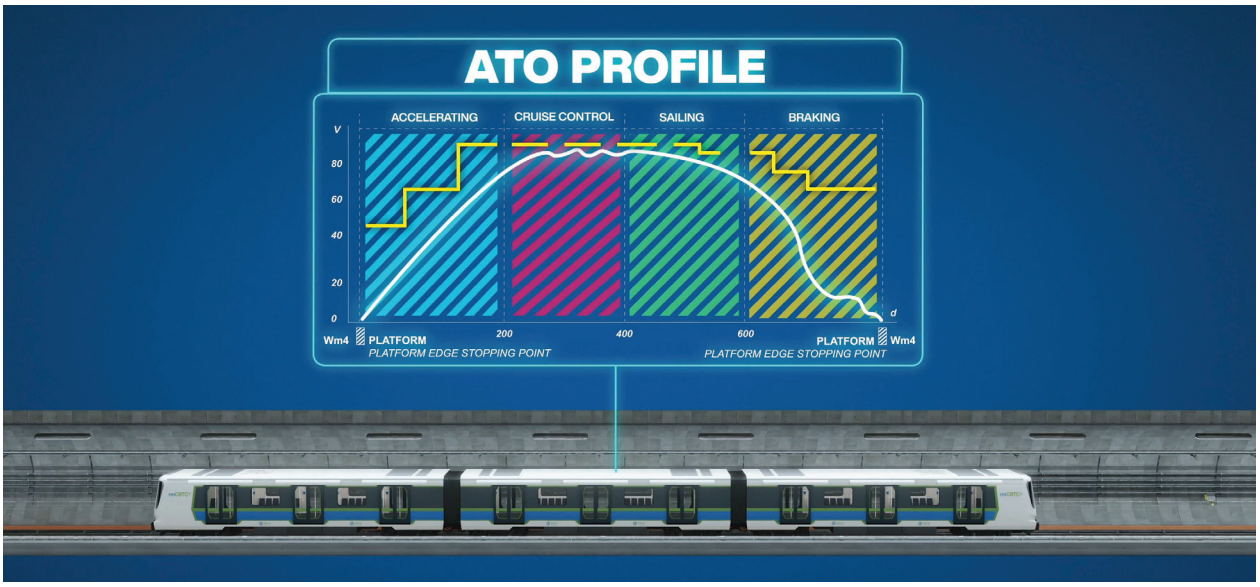
Vehicles are guided in-line according to the moving block principle which allows to significantly reduce headway of equipped vehicles moving within the system boundaries. As a result, the general track capacity and efficiency of the transport system are increased.



The functionalities performed by the system allow to optimize the traffic management process which includes keeping the operating costs low and guiding trains automatically according to the timetable.



The system can safely reduce the speed of trains if the traffic situation requires it. The entire action is performed according to functionality of the ATP systems and regardless of the train driver's reaction. Functions of ATO and ATS systems allow to automate the train control process based on pre-defined speed profiles.

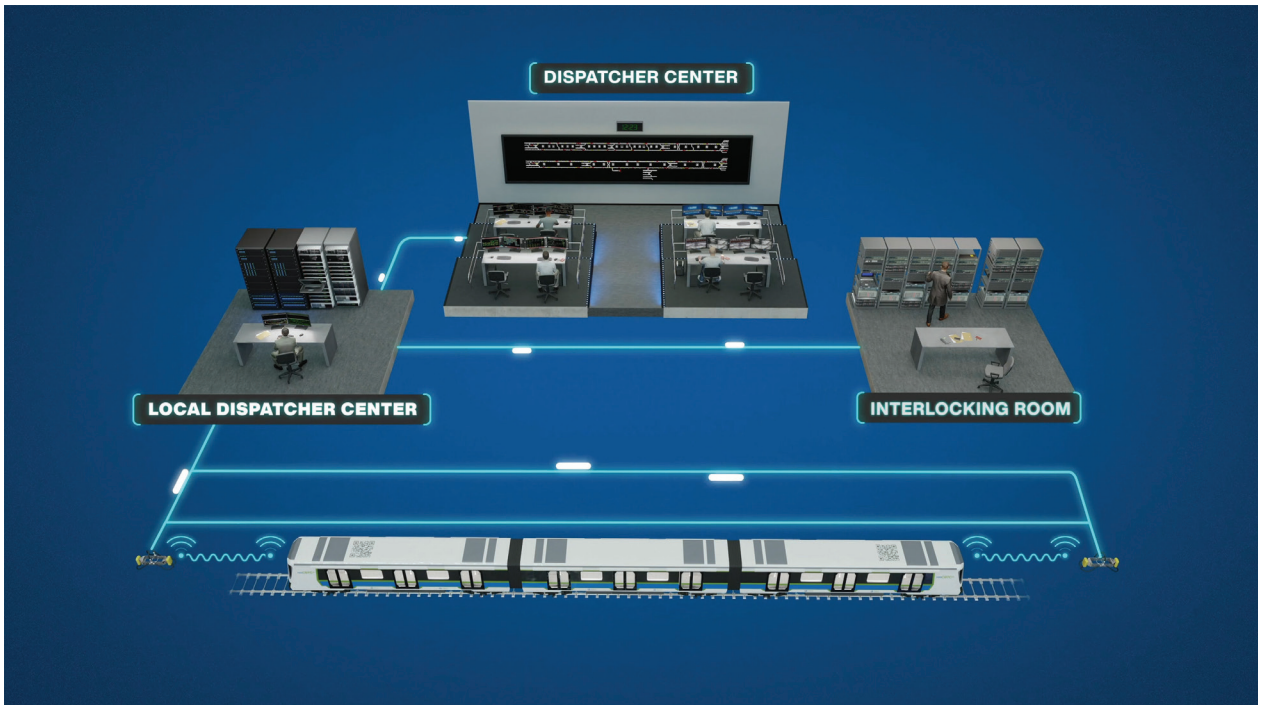


The rmCBTC® has a centralized, on-line component diagnostics which provides a comprehensive analysis of the entire system, as well as more refined data on each infrastructure and train component. Built-in system diagnostics can be utilized for the purpose of predictive system maintenance.

The centralized and scalable system architecture along with the existing infrastructure systems allows to automate the trains' headway management, save energy in energy-saving or maximum efficiency mode, remotely control the train traffic, and solves any conflicting situations which emerged on the line.

The following functionalities carried out by the on-board devices of the rmCBTCp sub-system:

- odometry function, including surveillance over distance travelled by the rolling stock from the last absolute location marker. The marker is situated in the track and calculates current speed of a moving train (speed&distance monitoring process);
- functions of safe driving conditions control ATP (Automatic Train Protection), including correct determination of braking curves and influence on vehicle braking control systems, which guarantee stopping before the dangerous point in the supervised system;
- ATO function, including control over propulsion and braking systems of the vehicle, allowing automatic train movement based on calculated ATO speed profiles;
- cooperation with the existing Train Control and Monitoring System based on interfaces defined for specific type of rolling stock;
- migration between the systems at the borders of the rmCBTC®;
- carrying out diagnostics, including diagnostics of components installed in the trains;
- generating Telepowering signal and receiving Uplink telegrams to and from balises which act as absolute location markers.



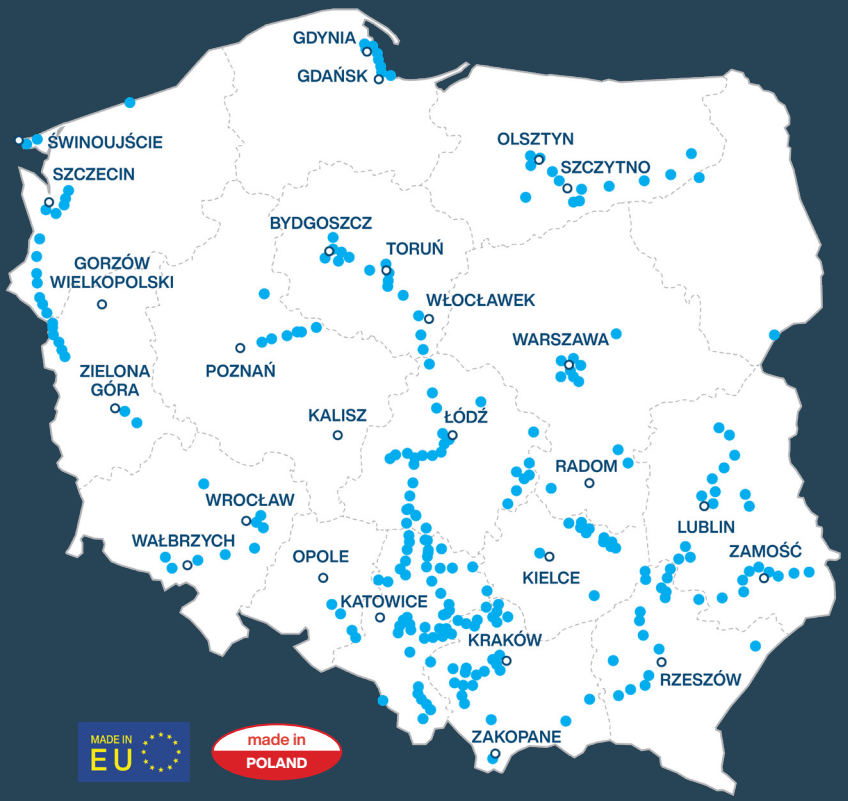
The following functionalities carried out by the stationary devices of the rmCBTCs sub-system:

- functions of safe driving conditions control ATP (Automatic Train Protection), including correct determination of movement authority (MA) for vehicles equipped with the vehicle component devices in the area covered by the system;
- ATO function, including calculating valid ATO speed profiles according to timetables and energy-saving operation;
- ATS function, including traffic control and management in the area covered by the system and surveillance over traffic situation, including correct identification and tracking of particular vehicles;
- cooperation between existing traffic control and management systems located in the infrastructure, including a remote dispatch control, management systems and electronic interlocking systems;
- executing functions at the system's borders, including correct initialization of system-equipped rolling stock and surveillance over non-equipped vehicles;
- diagnostics, including diagnostics of the system components installed in the infrastructure;
- supplemental one-way, train-to-ground transmission using trackside balises, used particularly for valid reception of Telepowering signals and generating Uplink telegrams, which act as absolute location markers.

Functionalities carried out by the rmCBTC® train-to-ground transmission sub-system:

- A continuous, bi-directional transmission between the main interlocking computer rmMAC and rmVC computers located in vehicles;
- transmitting vehicle's location information to main interlocking computer rmMAC;
- transmitting moving authority (MA) to rmVC computers located in vehicles.

Installed systems utilizing components produced by Rail-Mil:



Selected case studies of systems utilizing Rail-Mil components:

KSP-7M
Level Crossing Protection System

rmSDO
System for Object Detection in the Danger Zone

rm110
Integrated Control System for the Rail Devices and Fire Protection System

CBL2010
Digital Line Block System

rmDSIP
Dynamic Passanger Information System

***rm110-CS**
Power Supply and Control Unit for the use of Fire Protection Devices

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