

MIPRO METRO SOLUTIONS



INTERLOCKING SOLUTION &
ATS AUTOMATIC TRAIN SUPERVISION

MIPRO

INTERLOCKING SOLUTION FOR METRO

Mipro's computer-based fail-safe metro interlocking system is developed to control and manage high-frequency and demanding rail operations. The modular and flexible system architecture enables various traffic and operation modes, future expansions and modifications, as well as easy integration in existing infrastructures.

MAXIMUM SAFETY AND AVAILABILITY

The metro interlocking system consists of fail-safe hardware, software and interfaces that form the basis for safe and fluent rail traffic management. It meets the highest requirements stipulated for systems related to railway safety. The system's hardware and software are SIL4 certified and implemented in accordance with CENELEC standards EN 50126, EN 50128 and EN 50129.

The metro system is fully redundant from the intelligent system core software and hardware up to data communication. The CPU processors of the system are internally redundant based on the two-out-of-two architecture which guarantees the highest safety integrity level and availability. The availability is further enhanced by the built-in features of the system platform that allow CPUs and all active modules to be duplicated, thus operating in full hot-standby. Consequently, a failure of one module does not cause failure of the entire interlocking.

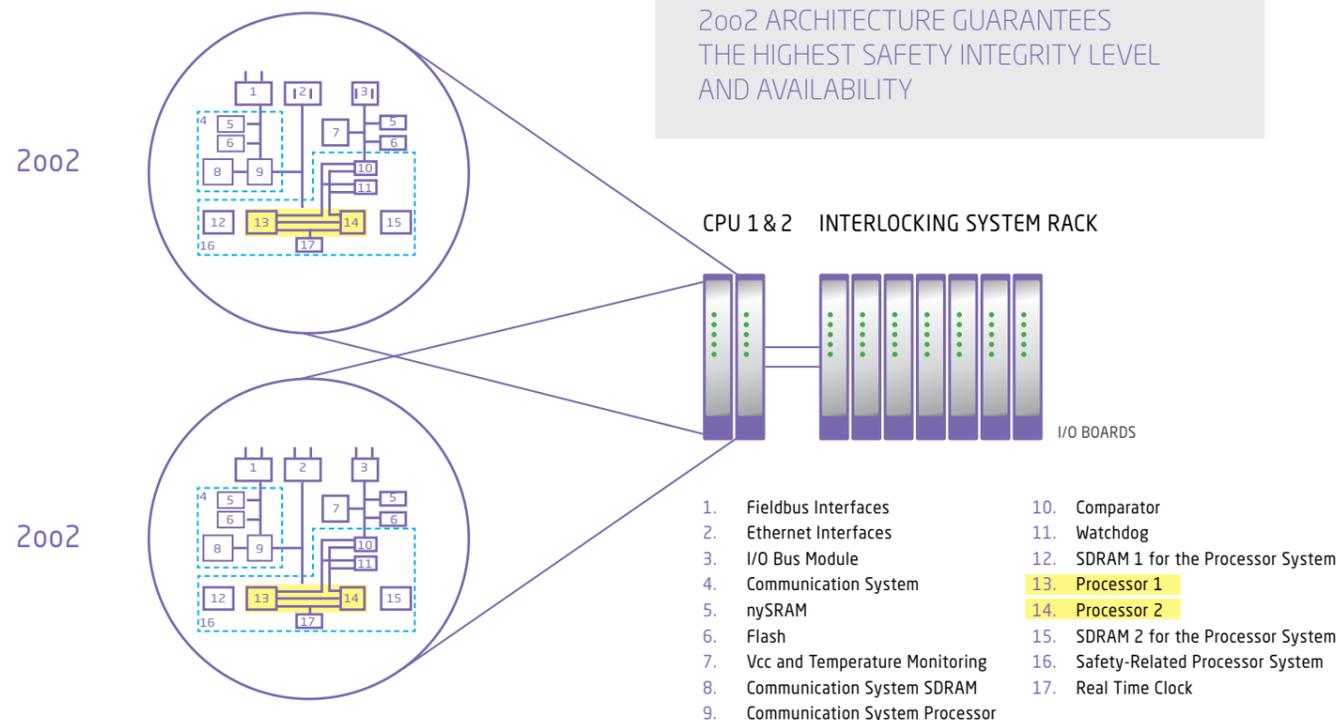
EASE OF MODIFICATION AND MAINTENANCE

The modular and flexible system structure allows extensions and modifications of the system according to track equipment or rolling stock requirements. Furthermore, it enables user-friendly maintenance, installation and commissioning. When modules can be maintained and replaced one at a time with the interlocking system in operation, disturbances for traffic and other systems are minimised.

The interlocking system components are designed to be maintenance free. Self-diagnosis of the interlocking system hardware/software and diagnostic of the wayside equipment is built-in in system platform components. If the system identifies faults inside the interlocking system components or in the connected wayside elements, faults are indicated to the ATS system's user interface.

The metro system platform utilises commonly obtainable hardware components and software that have been proven for their reliability and functionality in the most demanding safety critical industry applications. This guarantees a long-term lifecycle support and applicability for continuous round-the-clock use.

2oo2 ARCHITECTURE GUARANTEES THE HIGHEST SAFETY INTEGRITY LEVEL AND AVAILABILITY



CENTRALISED, DISTRIBUTED OR MIXED ARCHITECTURE

ACCORDING TO CUSTOMER NEEDS



Mipro's metro interlocking system is based on object-oriented design and programming principles and thus provides centralised, distributed or mixed architecture solutions for various environments, depending on the customer's requirements. The distance between interlocking and field elements and the cable-laying work can thus be optimised and minimised.

The interlocking system provides easy integration in existing infrastructures and interfaces with several types of point machines, interlocking, signalling, track

circuit, train detection and ATP equipment. It connects seamlessly with other external systems as well, such as fire door control safety systems, emergency stop handles and facility surveillance systems.

The interlocking system controls and monitors the operation of rolling stock and track equipment on the traffic section according to commands issued. The system is controlled either manually from the control centre or the control commands are conveyed through the automatic route setting equipment.

FOUR DIFFERENT OPERATION LEVELS TO CONTROL AND MANAGE TRAFFIC:

1. Control centre level, ATS system with automatic route setting
2. Interlocking level, interlocking system
3. Interfaces to track equipment, track equipment interfaces and their control
4. Track equipment

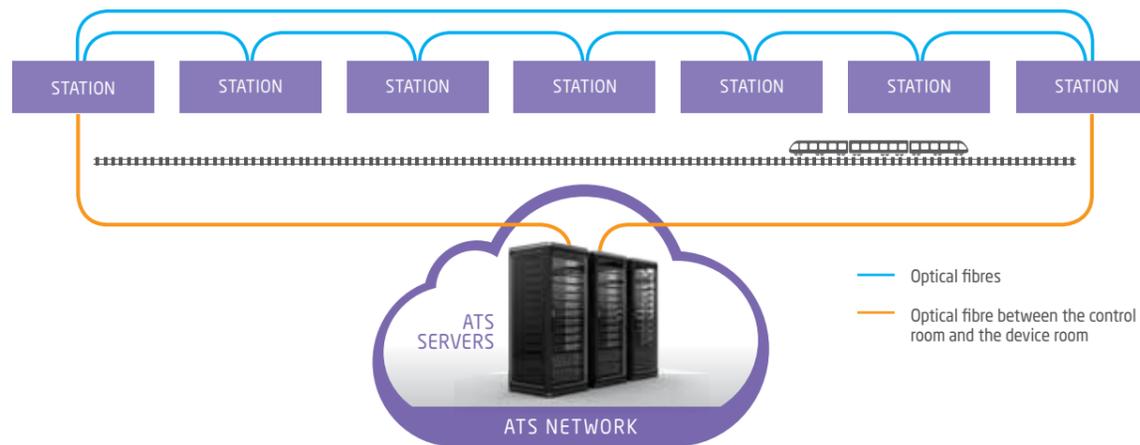
The interlocking system is implemented using defined architecture layers with each layer divided into a necessary number of modules in order to achieve the required system capacity. The modular system structure (hardware and software) can be easily expanded, so there is no need to limit the number of controlled elements and track equipment.

MAIN SYSTEMS

The operation of the metro interlocking is based on the following main systems:

POINT MOTORS	Point motors (common 5 or 7 wired motors) are controlled and supervised by Mipro's MiSO TC Turnout Controller.
SIGNALS	Signals are based on LED light units. LED units and fibre optical signals are controlled with Mipro's MiSO SC Signal Controller.
AUTOMATIC TRAIN RUNNING CONTROL	Based on track magnets or another ATP system.
TRACK VACANCY DETECTION	Track vacancy and train detection can be implemented with the audio frequency track current circuit or axle counting system.
LINE BLOCK SYSTEM	The line block system integrated into the interlocking system enables the reservation of block lines for one rolling stock unit at a time, which prevents collisions in all cases and in all traffic areas.
RESPONSE TIMES AND PERFORMANCE	The performance of the interlocking system platform meets high traffic density requirements of any metro solution.

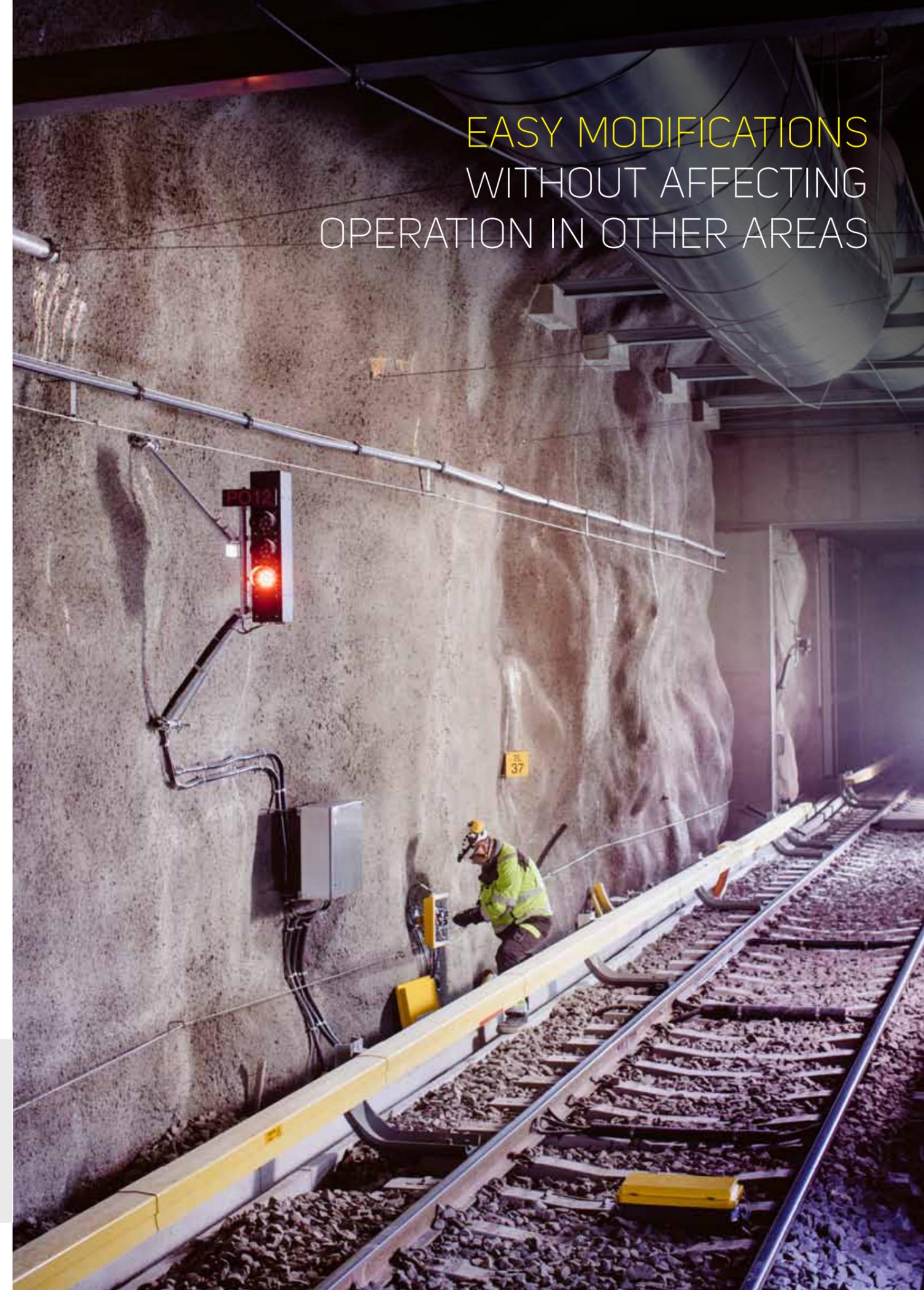
MIPRO INTERLOCKING SOLUTION



KEY BENEFITS OF MIPRO INTERLOCKING SOLUTION

- > High availability and reliability
- > Compatibility with existing trackside equipment and systems
- > Long product lifecycle through future-oriented technology
- > Online diagnostics and test system
- > Easy modifications without affecting operation in other areas
- > Scalability through modular configuration
- > Two-out-of-two architecture for all modules

EASY MODIFICATIONS
WITHOUT AFFECTING
OPERATION IN OTHER AREAS



MIPRO ATS AUTOMATIC TRAIN SUPERVISION

Mipro's ATS automatic train supervision and control system is based on modern computer technology and developed for reliable and efficient rail traffic control and management. Its functionalities and features are designed for fully automatic operations and for demanding control environments with high traffic frequency. The operational environment of the system is designed according to customer and national requirements and in the required language.

MODULAR SYSTEM STRUCTURE AND REDUNDANCY ENSURE HIGHEST AVAILABILITY

The ATS operation control system is based on the proven principle of a modular system architecture which is highly adjustable and flexible for specific application purposes. The system can be implemented and commissioned in phases and new traffic areas can be easily added under the control of the system at any life-cycle stage.

Availability and reliability are further enhanced by the system's proven technologies and redundant platform features. The ATS system is designed to tolerate unexpected computer and component failures. This is achieved by using hot-standby redundant and real-time system servers which back-up each other in a failure situation and ensure uninterrupted use of the system.

EASY INTEGRATION AND CONSISTENCY OF OPERATIONS

The ATS system integrates seamlessly to various interlocking systems and provides a unified operational environment, data transmission connections and interfaces for interlocking control of a track section.

Third-party systems installed on the traffic areas can be connected to the system so that data related to traffic control can be transmitted through the workplaces for use by dispatchers. Tunnel systems (such as fire alarms, fire doors and facility surveillance systems), current supply systems, passenger information and timetable systems are easily connected to the Mipro's ATS system.

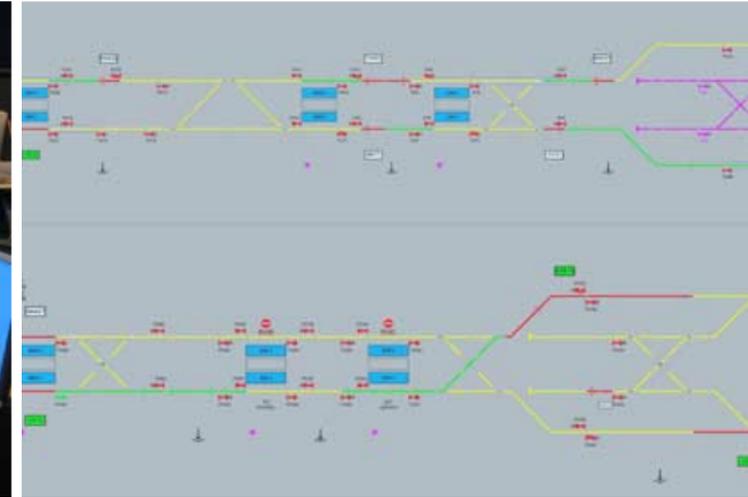
The ATS system includes several automatic functions that facilitate the dispatcher's daily work and prevent human errors. These functions include automatic route setting, graphical train data from train movements and timetables, automatic or manual train number function, and data from various other sources e.g. video surveillance, fire detection. Each function and its detailed activity are defined in co-operation with the customer and any system feature can be added later to the system during its life-cycle.

ATS SYSTEM STRUCTURE AND HARDWARE

The ATS system is based on modular hardware components and software modules. The workstations and remote control servers are based on Microsoft Windows software environment which ensures easy integration with third party applications. The main system parts and components are:

- > Redundant (hot-standby) real-time ATS system servers
- > Workstation servers and ATS operations control workstations
- > Control and dispatching tools and software for automatic and manual control of rail traffic.

The ATS system platform utilises commonly obtainable components which are easily replaceable and maintainable. In this way, we guarantee constant and cost-effective system development.



FULLY AUTOMATIC FUNCTIONS FOR VARIOUS TRAFFIC SITUATIONS

The ATS operation control system features and functions are designed to support fully automatic operation based on predefined timetables, routes and train services. Timetables can be downloaded from the traffic control system in use or from an external design system, for example Hastus or RailML.

In disturbance and conflict situations, the user is informed through different types of visual and audio indications. In exceptional traffic situations, the user can change the function of the automatic operation and set it into various exceptional traffic modes.

DYNAMIC PASSENGER INFORMATION SYSTEM

The ATS system can be used to control the info displays and automatic announcements of the platforms. The information on the info displays is automatically and dynamically updated and controlled by the ATS system. Info displays can be used to show the arrival time of the next train, type of the rolling stock, and special texts. Ready-defined info texts and announcements can be defined for the system.

SIMULATOR AND PLAYBACK ARE PART OF SYSTEM CONFIGURATION

The simulator and playback are basic features of Mipro's ATS system concept. The simulator is specially designed for training dispatchers and testing and defining automatic functionalities. Furthermore, it can be used to simulate various signalling and interlocking systems to enable their accuracy and functionality to be tested in a real traffic control environment prior to commissioning.

Simulation runs on its own server and does not affect traffic control functions or performance. The entire area controlled by the ATS system and all functions of the ATS system starting from train number automatic operation are available for simulation.

The simulator can be integrated into the playback event recorder, allowing recordings from the live environment to be used as basis for simulation. For example, the simulator can carry on the function from the point where playback recording stopped.

KEY BENEFITS OF MIPRO ATS AUTOMATIC TRAIN SUPERVISION

- > Fully automatic operation for high frequency traffic environments
- > Modular and scalable system architecture
- > Availability and adaptability
- > Easy integration with interlocking and other systems
- > Function modes for specific traffic situations
- > Simulator and playback functions as integral system parts





CASE/ WEST METRO SIGNALLING SYSTEM PROJECT 2015-2016

Mipro's interlocking system and ATS operations control system control the traffic in West Metro - We have delivered, within a tight schedule, a total solution suitable for the West Metro environment.

Mipro has delivered the interlocking and ATS systems and the passenger information system for the new West Metro line, the western metro extension of the existing Helsinki metro. For the rail line of 14 kilometres, Mipro delivered nine new interlockings systems. The total system solution also includes an interface to the existing Helsinki metro interlocking system, which enables fluent and efficient use of the lines together. The interface is implemented so that the passenger does not notice any interface between various systems.

The interlocking system project for the new metro line commenced at the end of March 2015 and was completed in the autumn of 2016. Mipro had total responsibility for delivery of the interlocking and ATS systems for the West Metro line. Consequently, the large number of contractors, subcontractors and other parties involved in the project required accurate and comprehensive project management.

> DOWNLOAD THE CASE STUDY: www.mipro.fi/references

FACTS AND FIGURES OF WEST METRO

- > 14 kilometres
- > 8 new stations
- > 170 000 passengers every day
- > The highest permissible speed is 80 km/h
- > The current traffic frequency of 4 minutes at the maximum will fall to 2.5 minutes after commissioning
- > Two parallel shafts

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