



SMART, EFFICIENT AND SAFE

Rail Automation Systems for Mass Transit from Siemens Mobility

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SIEMENS



Mass Transit Solutions

Intelligent and future-oriented mass transit systems for passengers and rail operators.

The Rail Automation systems from the world market leader and pioneer of railway signaling systems create the relevant conditions for enhanced safety, punctuality, speed, capacity and energy efficiency both along lines and at stations. Siemens Mobility opens up the way for trains within the network and specify when, where and how fast trains should travel. A special focus lies on the optimization of entire operational sequences within rail transport. Rail Automation employees are developing and producing innovative solutions in the fields of train control, interlocking systems, operations control systems, components, track vacancy detection, level-crossing protection, and rail communications.

Modernization and Migration without Disrupting Operations

Siemens Mobility offers modular and scalable solutions that permit existing systems to be converted and upgraded step by step without service interruptions. We offer expertise and experience in the implementation of major modernization projects worldwide.

Availability as the Basis for More Efficiency

Siemens Mobility's products ensure maximum system availability and cost-effective operation. An integrated service and diagnostics concept makes sure that every system runs smoothly. Any deviation from standard system behavior is detected, recorded and reported. Faults are located and remedied quickly and efficiently, and system downtimes for maintenance and servicing kept to a minimum.

More Passengers in Less Time

Our goal is to provide efficient mass transit systems that are capable of being quickly adapted to new requirements. The "green and efficient" metro of the future is about much more than optimizing individual parts of a mass transit system. Siemens Mobility can help design architecture, technology and solutions for environmental compatibility. In a lot of projects around the world, we have proven not only the excellent technical performance of our solution, but also high integration ability as well as an efficient, solution-oriented project management.

North America Projects

- **USA | New York City Transit – Carnasie Line**
Communication Based Train Control
- **USA | New York City Transit – Dyre Avenue Microprocessor Interlocking**
Signaling Components
- **USA | TriMet – Portland to Milwaukee**
Wayside Signaling and Communications
- **USA | San Diego – Blue Line Wayside Signaling**
Signaling and Pre-Wired Signal Control Housing
- **USA | New York City Transit – PACIS**
Rail Communication

| System Integration Capabilities

First-class project management – always in close cooperation with our customers.

Siemens Mobility is the world market leader in rail automation and offers the complete portfolio from single components to complex overall systems:

- Railway signaling and safety systems as well as rail automation systems for mass transit systems
- Operations control systems with scheduling, planning and dispatching functionality for continuous operational optimization

From the design and manufacturing of new components to complete infrastructure solutions – our competence in project execution has been demonstrated in many projects worldwide and is the backbone of our business. Siemens Mobility has proven to be a reliable and competent partner from planning, configuration and implementation. Our high-quality products and our internationally recognized competence in project execution provide the basis for a stable and reliable partnership with our customers. In close cooperation with our customers, we develop continuous configuration concepts, precisely tailored to their installations and requirements. If requested, we take on the entire scope of work as general contractor for a complete turnkey project. Alternatively, we cooperate with customer teams and/or subcontractors.



Our global experience is backed up by our employees in North America – Siemens Rail Automation proudly designs, integrates, and manufactures systems and products utilized in making the US mass transit rail systems more efficient and sustainable.

Minnetonka, MN

- Rail IT
- Engineering
- Project Management

The Minnetonka, MN office is the international supplier of operations control systems of the Vehicle and Infrastructure Control and Operating System (Vicos OC) product that manages train operations for mass transit. It integrates automatic train control systems and full SCADA functionality. A comprehensive suite of features of train conflict resolutions, web-enabled interactions, comprehensive traffic and maintenance workflow management, interactive intelligent traffic optimization, data analytics for regular and failure mode scenarios, as well as full-featured simulation and case studies, are brought about through project management, engineering, integration, hazard analysis, testing, and commissioning.

Marion, KY

- Manufacturing

The Marion facility serves as the primary products manufacturing facility for all of our Freight and Products business. The facility serves as our wayside and crossing cantilever welding facility and our primary facility for the wiring of wayside signal systems for our primary class one freight customer.

Louisville, KY

- **Engineering**
- **Manufacturing**
- **Product Support**

The Louisville office serves as the Global Headquarters for our Freight and Product Business as well as a competence center for the project management, engineering, design, and integration of rail transit train control systems. This facility also functions as the manufacturing facility for assembly and wiring of the complex control equipment required for train control systems, wayside signal systems and grade crossing warning systems.

New York, NY

- **Engineering**
- **Projects**
- **R & D**

The New York office is the center of competence for the design, integration, and commissioning of Communication Based Train Control and communication systems. Siemens Mobility engineering and R & D develops systems that increase the mass transit network capacity and throughput to meet increasing demands for efficient mass transit solutions.

Pittsburgh, PA US Regional HQ

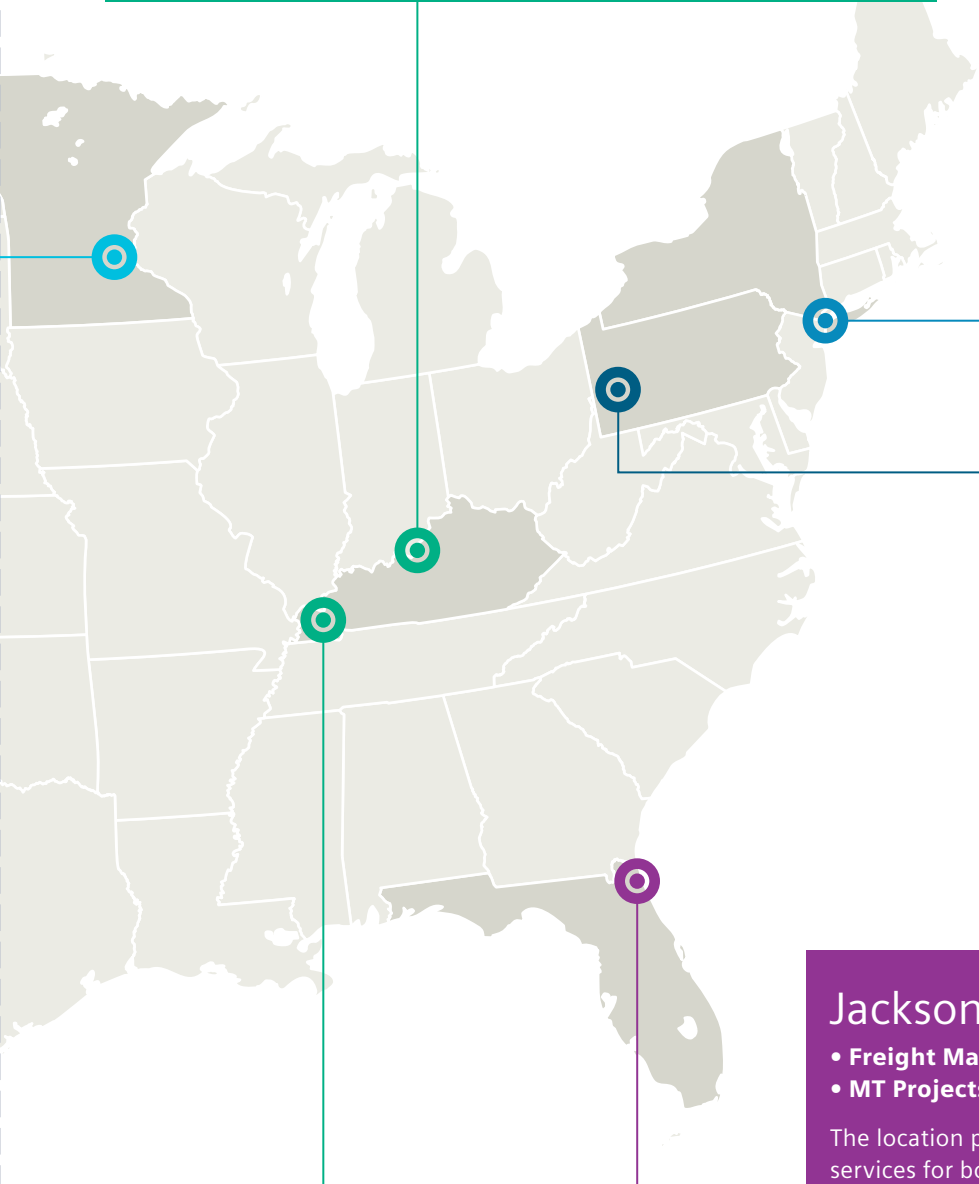
- **Carborne Systems and Component Manufacturing**
- **Engineering**

The manufacturing facility engineers, assembles and wires the complex control equipment required for train control systems, including Positive Train Control (PTC), a signal enforcement system that leads to more efficient train control, specifically for the North American market.

Jacksonville, FL

- **Freight Management**
- **MT Projects**

The location provides wayside and crossing engineering services for both freight railroads and transit authorities. Focusing primarily on Positive Train Control (PTC), obsolescence and capacity projects, the Jacksonville design group supports both hardware and software design including integration support across a variety of platforms.





Siemens Mobility, world market leader in rail automation, offers the complete portfolio from single components to complex overall systems:

Electronic interlockings monitor and control safety-related facilities in line with the dependencies between signals, points and vehicles. Siemens Mobility also supplies fully integrated electronic interlockings that are completely preassembled and tested at our System Test Center.

Electronic Interlockings

- Trackguard Westrace MkII

Train Control Systems

In driver-based train operation, the train control system supports the driver with safety-related and operational functions.

Communications-Based Train Control Systems

- Trainguard MT

Intermittent Train Control Systems

- Trainguard Zub222c

Positive Train Control Systems

- Trainguard ACSES PTC
- Trainguard I-ETMS

High-Speed Train Control Systems

- Trainguard ETCS

Operations Control Systems

With operations control systems from Siemens Mobility, electronic and relay interlockings can be controlled and monitored. In addition, our operations control systems Controlguide Vicos, feature a large number of automated functions.

- Operations control systems
- Remote control systems
- Service and diagnostic system
- Dispatching system

Components and Subsystems

Siemens Mobility provides the full range of components and subsystems from axle counters and point machines to LED signals from one and the same source. In top quality, designed and built for fault-free installation, maximum availability and simple maintenance.

Signals

- RT Transit Signal
- CLS-1000
- CLS-2000
- V-Type

Train Detection Systems

- Remote-fed audio-frequency track circuits
- Clearguard ACM-200 Axle counting systems

Grade-Crossing Protection Systems

- Grade-crossing protection systems
- Gate Mechanisms
- Flasher Light Signals and Gate Assemblies
- Radio-operated approach indicators

Other Systems

- Trainguard IMU-100 Train-To-Wayside communication system

Siemens Mobility Solutions for Mass Transit

Optimal performance with the world's leading automatic train control system for mass transit.

The overall performance of mass transit systems depends largely on the performance of the Automatic Train Control (ATC) system deployed. With increasing automation, the responsibility for operations management gradually shifts from drivers and operators to the system.

An ATC system comprises functions for the monitoring, execution and control of the entire operational process. The ATC system continuously indicates the current movement authority on the cab display and supervises the permissible train speed. Color light signals are therefore no longer required. The modular and future-proven Trainguard MT automatic train control system is Siemens Mobility's answer to the comprehensive requirements of mass transit today and offers the latest standard in automation at different level.

As a modern modular ATC system, Trainguard MT offers all these features, providing the basis for attractive, safe and efficient mass transit systems which answer to the needs of both passengers and railway operators throughout the world.

Trainguard MT CBTC

Communication Based Train Control

The modular train control system Trainguard MT CBTC provides the signaling basis for attractive, reliable, and efficient mass-transit systems. The radio-based system allows a choice between fixed or moving block operation and achieves headways of 90 seconds. Trainguard MT CBTC includes functions for monitoring, implementation and control of the entire operating sequence. It can be implemented in different degrees of automation such as semiautomatic operation and operation under driver control.

Trainguard MT CBTC is based on tried-and-tested automatic train control solutions such as New York City Canarsie CBTC project, which demonstrates Siemens Mobility's expertise in the field of radio-based train control and brown field environment. Thanks to standardized interfaces, Trainguard MT CBTC is compatible with various different operation control systems, interlocking designs and track-vacancy detection systems, ensuring interoperability between new and existing systems.



Benefits

- Short headways by implementing real moving-block operation
- Cost-effectiveness
- Scalability
- Maximum reliability and availability
- Economical maintenance
- Support of mixed-traffic environments
- Flexible refurbishment and migration solutions
- Support of holistic rail automation solutions
- Energy-efficient driving (saving of traction power)



Trainguard Zub 222c

Performance in
transportation
you can trust.



Trainguard Zub 222c Automatic Train Control System

State-of-the-Art Technology for Cost-Effective Rail Services

System with Cost-Effective Benefits

Refinements of train control systems are crucial for new rolling stock. They are to be universally applicable all over the world in the future and, in particular, to be capable of being integrated both simply and cost-effectively.

With its wide range of functions and its modular design, the Trainguard Zub 222c automatic train control system meets the latest requirements for signaling and safety. The new compact on-board unit and energy-efficient trackside equipment, connected to the signals via interface boards in Eurocard format, can be easily installed in new signaling systems and retrofitted to existing systems.

Trainguard Zub 222c ensures cost-effective, easy-to-maintain operations. It places no specific requirements on the signaling system of the railways to be protected, and can be individually configured and thus adapted to any application.

A special feature of Trainguard Zub 222c is its suitability for mixed operation as both a heavy rail system with exclusive rights-of-way separated from other traffic and a light rail system with shared rights of-way together with other traffic in city streets.

For this purpose, Trainguard Zub 222c provides an integrated back-channel to the track in addition to the fail-safe track – train data channel. These backchannels (coupling coil or radio) permit the control of decentralized electric points, priority switching at traffic lights, or train tracking, as well as diagnostic and status data.

Basic Functions of the System

Trainguard Zub 222c works with intermittent data transmission from the track and ensures continuous monitoring of a speed profile. This type of monitoring with target braking curves significantly reduces overlaps, thus optimizing line throughput. Thanks to this feature, Trainguard Zub 222c is a low-cost-alternative to continuously transmitting systems and supports the driver by means of numerous automatic functions:

- Continuous and reliable monitoring of speed and braking
- Display of the target and actual speed in the driver's cab
- Audible alarm when the target speed is exceeded and automatic brake application
- Train stop at stop signals
- Monitoring of speed restriction sections
- Non-fail-safe bidirectional transmission of information between track and train

Office Control Systems OCS

Intelligent Operations Control Systems

Controlguide OCS provides functions for all levels of rail traffic control and operations management and features:

Fully Integrated Control of Operations

Controlguide OCS enables you to plan and carry out your operations. In the event of deviations in planned operating sequences, Controlguide OCS enables you to use intelligent dispatching functions to minimize any resulting disruptions. Thanks to an intuitive user interface, you can intervene in day-today operations, both effectively and efficiently, particularly in difficult situations.

Centralized Monitoring

Different types of interlocking systems and train control systems can be monitored and controlled by Controlguide OCS. These functions can be centralized for even more effective operations management for individual lines or regions or even for complete networks.

Automation on Demand

With its high-performance automation functions, Controlguide OCS offers ideal conditions for centralizing operations management. Whatever is required of your systems' performance and functionality, Controlguide OCS supports different solutions through to fully automatic unattended train operation (UTO) with extended automation functions for handling emergency situations.

Intelligent Dispatching Functions

With the increasing complexity and centralization of operations management, deviations during operations may

entail considerable consequences. That is why Controlguide OCS provides you with intelligent dispatching functions. Even in exceptional situations, these functions will guarantee a high level of performance and reliability in rail services.

Benefits

- Increased performance through optimized usage of existing resources and capacities as well as high-performance automation functions
- Guaranteed high-level operative availability, even in exceptional situations, due to intelligent dispatching functions
- Improved quality and customer satisfaction through optimum support in handling deviations during planned operations
- Lower implementation and life-cycle costs thanks to the product platform as a basis for customer-specific adjustments
- Flexible organization through adjustable allocation of monitoring areas and functions to workplaces and handling of different tasks by mobile equipment, irrespective of the actual location
- High-level usability due to the user-friendly HMI and intuitive operations control workflows
- Expandability and increased performance as required; low-risk integrability into an existing infrastructure due to the modular and scalable system architecture with open interfaces
- Support of safety-critical commands through procedure-protected control and display

Trackguard WESTRACE MkII Interlockings

Advanced, Flexible, Powerful and Easy to Use

Product Overview

Siemens Mobility knows that one size doesn't always fit all. That's why Siemens Mobility offers integrated modular interlocking equipment that provide the optimal interlocking solution. Whether you need a large or small interlocking, whether you need the interlocking function adjacent to, or remote from, the trackside equipment, whether you want centralized or decentralized interlocking logic – these are just a few of the possibilities that can be integrated into one system. Our options allow for optimization of installed cost – hardware, design, test and commissioning – or whole-of-life cost, where maintenance and availability are critical elements that impact on the railway service. Our interlocking support tools improve the efficiency of design, principles testing and commissioning. They include many design automation functions, and include utilities that log and replay events to assist Maintainers in locating and rectifying faults.

Benefits

- Low total cost of ownership
- Suits centralized, distributed and hybrid
- Flexible Architecture with full redundancy to the board level if required
- High availability just where you need it
- Industry-standard Ethernet communication
- Design and service tools slash costs
- No fleeting outputs
- Ladder logic, with simple PC design and testing
- Re-use current interlocking data

Phase Shift Overlay (PSO) 4000

Overview

The Phase Shift Overlay (PSO) track circuit is used to provide track occupancy information for a train detection system. The PSO is a reliable and secure, microprocessor based, vital system for use in a variety of complex installations.

The PSO 4000 Is Available in Four Configurations

- The Standard configuration consists of separate transmitter and receiver assemblies.
- The Transceiver consists of an integrated transmitter and receiver within a single package.
- The IPI (Island) consists of an integrated island with crossing logic.
- The Crossing Package includes two receive modules and a combination transmitter/receiver island circuit module in a single case.

Benefits

- Transmitter, Receiver, Crossing and Transceiver Configurations
- Two Vital Inputs and one VRO on Transmitter Configuration
- Two Vital Inputs and three VRO on Receiver, Crossing and Transceiver Configuration
- Programmable for all common PSO II and III, AFTAC & METRA Carrier Channels
- Internally Programmable Pick-up and Drop Delay Times are available
- Internally Programmable Vital Stick Release Timer Functionality embedded within Crossing Package
- PSO Channels Compatible with existing PSO-II and PSO-III equipment
- Program Selectable Modulation Codes "A," "C," and new 16 bit codes "D" "E" and "F"
- Ability to Dynamically Select Codes via Vital Inputs or ATCS Interface

Clearguard ACM 200 Axle Counting System

Smart Track Vacancy Detection for Cost-Effective Rail Services

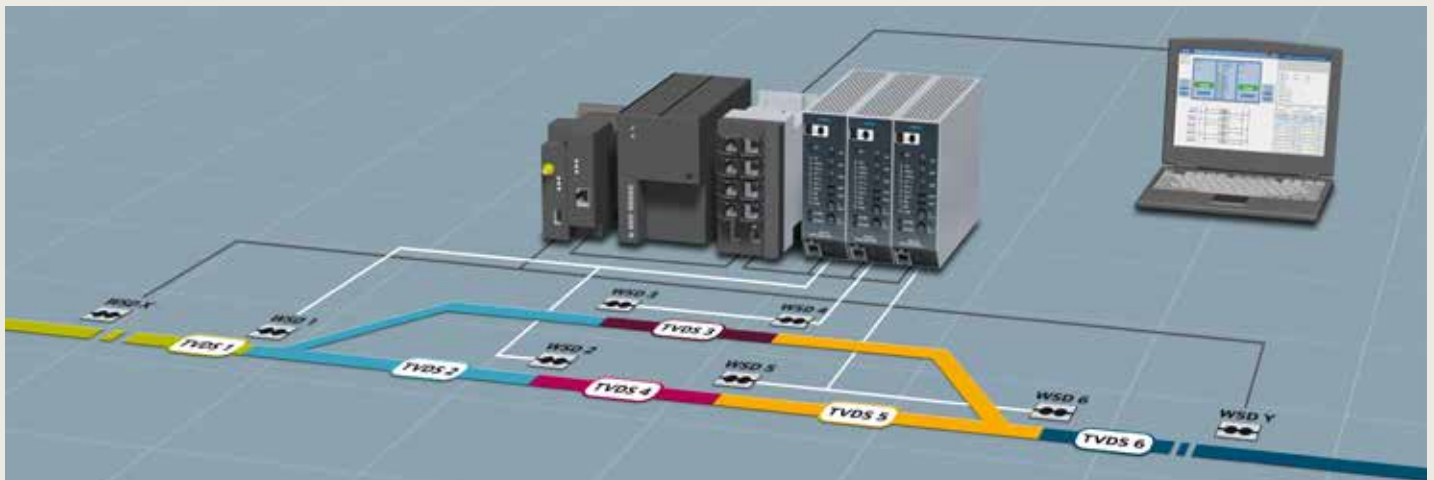
A track vacancy detection system supplies the information about whether a track in a particular section is clear or occupied, thereby permitting safe, trouble-free and efficient operations management. The Clearguard ACM 200 axle counting system is made up of maintenance-free Clearguard ACM 200 modules which are programmed via an ID plug and combined with an Ethernet bus and Clearguard ZP 43 E/V and Clearguard ZP D 43 counting heads into a fail-safe axle counting system.

Fields of Application

- Commuter and regional railways
- Metro and tramway systems
- Single-track and multiple-track lines
- Lines with and without blocking
- All traction types
- All common types of car
- Track sections of any length

Benefits

- Connection to electronic and relay interlockings
- HTML communication for attribute configuration, logging and diagnostics
- Modular, compact hardware
- Innovative diagnostic concept
- Deployment of Clearguard ZP 43 E/V and Clearguard ZP D 43
- Counting heads



IMU-100 Train to Wayside Communication System

Efficient and Reliable Rail Operations

From the Vehicle to the Track and Back Again Transmission of Information and Location-Related Control Commands

The Trainguard Imu 100 system is an information transmission system with a modular design. It is used for transmitting information from the vehicle to the track and vice versa. Data is transmitted in the form of telegrams at a rate of 50 kBaud using time-division multiplexing. A large volume of transmitted data is thus available for controlling equipment in mass transit systems.

The Trainguard Imu 100 inductive transmission system meets the requirements of modern transport systems for:

- Short headways
- High traveling speed
- High level of availability
- Simple configurability and maintainability
- Up-to-the-minute passenger information
- Reduction in the number of duties for the crew
- Effective train tracking for daily operations

Always on Stand-By Train-to-Track Information

Transmission Telegrams transmitted from the vehicle are received by the Trainguard Imu 100 receiver via antennas or loops. The received data is then forwarded to connected units via various interfaces. In this way, it is possible to transmit control commands to interlockings or the entire vehicle telegram to a control center. Location information is transmitted to the vehicle via location beacons. Data is exchanged via an air gap of max. 400 mm between the vehicle antenna and the trackside antenna or loop.

Trainguard Imu 100 System Is Mainly Used for Transmitting

- Setting requests to point controllers and light-rail signal control systems
- Vehicle telegrams to depot control systems for dispatching purposes
- Vehicle positions for tracking purposes
- Commands to traffic control computers and level-crossing systems
- Trackside data to the vehicle (e.g. door release, step board height)
- Control commands for platform screen doors as well as for precise determination of the vehicle position for up-to-the-minute and accurate passenger information



LED Signal Light Units

Cost-Efficient Operations Management through the Use of LEDs

LED signal light units and indication modules are used for the purpose of signaling light dots and symbols in railway operations. In comparison with optical systems featuring signal lamps, LED signal light units and indication modules are virtually maintenance-free. The choice of LED signal light units and indication modules depends on the signal color, the element operating module to be controlled, and the required visibility conditions for the signal.

Benefits

- High level of availability and reliability and thus safety
- Low operating and life-cycle costs
- Very long service life in comparison with optical systems featuring signal lamps
- In the event of single LED failure, unimpaired overall functional integrity of the signal light unit
- Low maintenance requirement

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