



AUTOMATION FOR MARSHALING YARDS

Trackguard Cargo MSR32

SIEMENS

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Freight transport by rail is an alternative to road haulage whenever goods are to reach their destination faster, more reliably and more economically. For railways, this means that transport has to be speeded up and transshipment time reduced. The modernization and, in particular, the automation of marshaling operations are making a major contribution to this effect. Siemens is a reliable partner supporting railways in this area and contributing many years of experience, competence and inventiveness.

The system for automation of marshaling yards – greater efficiency and safety in freight transport

Rationalization through modern microcomputer technology With expertise gained over many decades

Cost-effective marshaling largely depends on two factors:

- the rationalization of operational sequences at all levels – from train arrival to train departure
- the maximum possible automation of all work cycles and humping operations

To this end, Siemens has developed the Trackguard Cargo MSR32 automation system for marshaling yards. This system has mainly benefited from the precise knowledge of customer requirements and control procedures.

The result: a modular, open microcomputer system which supports adaptation to different performance requirements. This is made possible by the system structure and the powerful performance of modern microcomputer technology. This means that it is not only smaller- and medium-capacity facilities which can be equipped with the Trackguard Cargo MSR32 system and if necessary expanded step by step. In particular, it can be used to automate high-capacity yards.

Trackguard Cargo MSR32 is a multi- microcomputer system. Siemens' worldwide tried-and-tested Simatic automation system is used.

The micro-computers are connected to each other and to the operator PCs via a local data bus (LAN). In order to minimize spare parts requirements and maintenance costs, the same boards are used for all controller types.

Application software We speak the right language

The application software for the controllers and operator PCs of the Track-guard Cargo MSR32 system works in a strictly problem-oriented way and was written in high-level programming languages. During development, particular emphasis was placed on consistently planned, well-structured and robust programming.

All system controllers are operated in real time. The software can be configured for special applications and various procedures. System and topology specifications are configured.

Mobile maintenance Having all information and tools ready in the field

Mobile retarder maintenance can be performed directly on the track using a mobile terminal unit, e.g. a tablet. This not only provides access to manuals and plans but also ensures a defined and secured sequence of maintenance steps. Activities such as retarder adjustment, response time measurement, initialization, etc. can be performed on site and exclusively by maintenance staff.

Maintenance monitor

Planning and keeping the overview

Using the maintenance monitor, maintenance staff has many options to get an overview of the current system status, quantitatively and qualitatively assess it, and plan their work. Preventive maintenance is also possible thanks to the precise documentation. The system status is assessed based on a three-color indication of the elements.

Hump control, operator control and display system (ABAS)

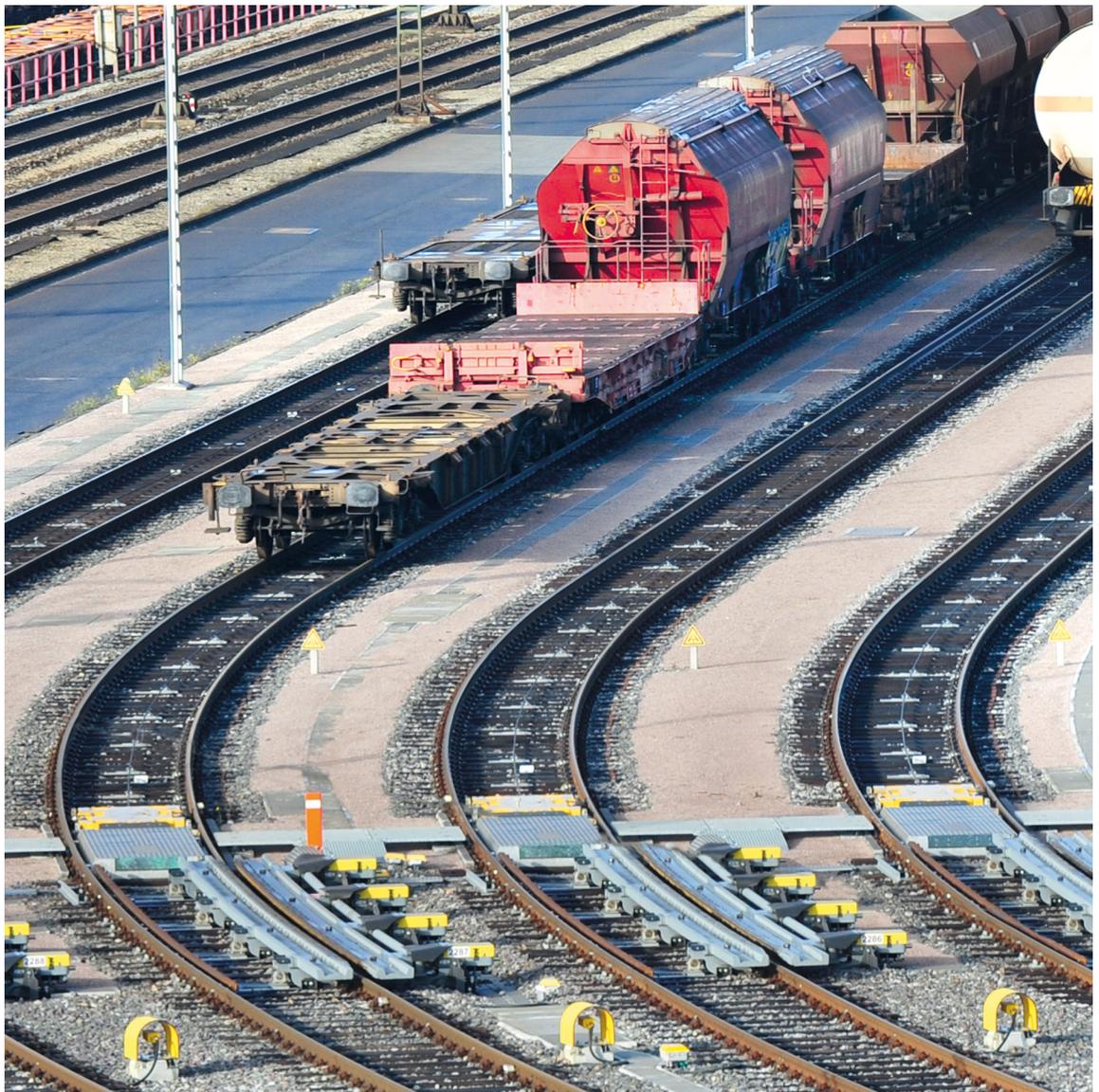
Rapidly in the picture at any time

The Trackguard Cargo MSR32 system is characterized by optimal operator guidance and short training and familiarization times. This is achieved using a full-graphics user interface with conventional Windows PC operation.

The special hump control, operator control and display system consists of two standard PCs, two monitors, one keyboard and one mouse. One of the monitors shows the track diagram at all times.

It contains all the information required by the operator, such as track clear/occupied indications, point positions, retarder operating state, etc. Using a second monitor (operating monitor), the traffic control staff use a keyboard or a mouse to perform all operator actions, thus handling the man-machine dialog. In addition to system and yard status displays, online help is also available.

Actuation of a function key facilitates assignment change between track diagram and operating monitor. Object-oriented operation using the mouse is then possible on the track diagram monitor.



IT security

Efficient protection

As a member of Charter of Trust, a network of leading IT companies for cybersecurity, Siemens develops products based on cybersecurity standards and using state-of-the-art technology. Customers will receive long-term contracts for maintaining and upholding IT security in Siemens systems, including product protection, the identification and resolving of vulnerabilities, and virus protection.

The MSR32 system

Siemens has drawn on its many years of experience in the field of marshaling in order to develop the state-of-the-art Trackguard Cargo MSR32 system.

All procedures used have been tested and field-proven. The performance of installations in Germany and other countries has proven the efficiency of yards in daily harsh marshaling operations.

Benefits

State-of-the-art control procedures

Automatic fault detection with graded responses to component failures

Flexible response to operational irregularities and bad runners with the aim of reducing corner impacts and avoiding catch-ups

Adaptation to variable weather conditions

Adaptive control algorithms

Approval for the control of marshaling areas

All procedures successfully tested and field-proven

Installation and commissioning also possible without interrupting operations

High-performance reference yards in Germany and other countries

Constant improvement and expansion of the functional scope, e.g. fully automatic control of the humping locomotive

Trackguard Cargo MSR32 enables:

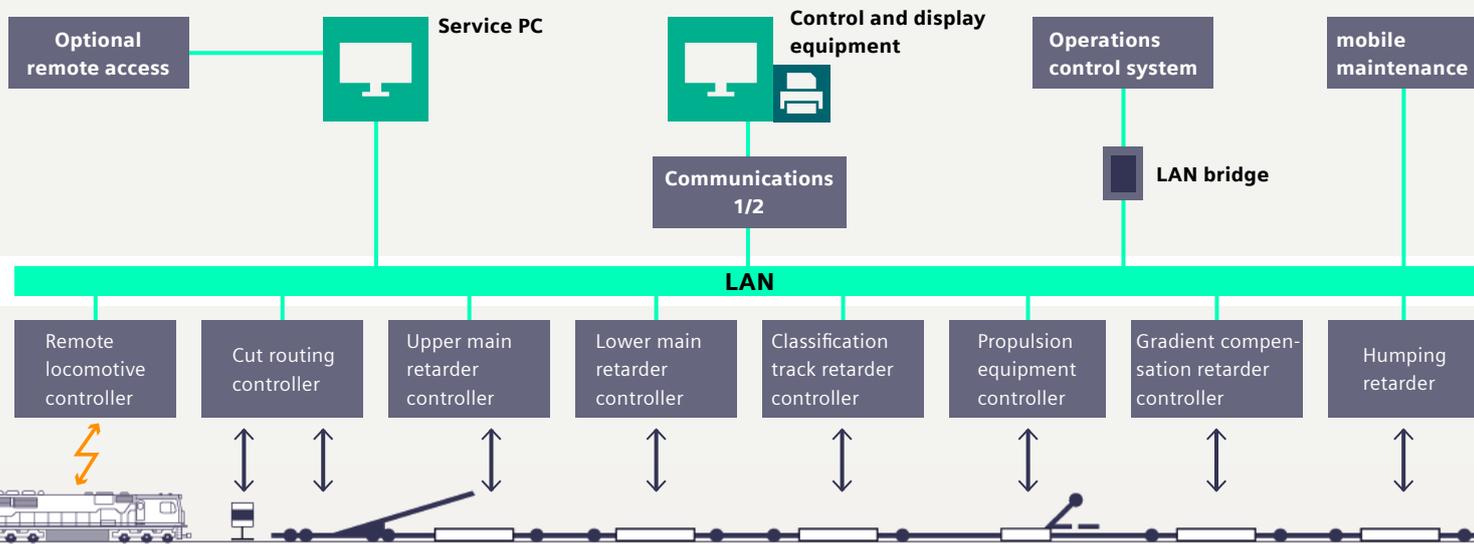
Reduction in marshaling costs per car

Reduction in rolling stock transfer times and thus in total transport times

Reduction in shunting damage

Fewer industrial accidents since dangerous work is taken over by the system

Competitive lifecycle costs through support of targeted, load-dependent maintenance



Cut routing control

Fast and safe

Efficient cut routing control, i.e. fully automatic route setting for all cuts from the hump to the classification tracks, must be both fast and safe.

The basis for this is the knowledge of the current locations and movements of all cars in the classification zone. All car movements are tracked using wheel detectors.

The exacting requirements in terms of the availability of wheel detectors and the necessity to detect the direction of travel require the use of double wheel detectors. The cut routing controller imposes corrective measures to ensure that failure of a wheel detector does not hinder the humping operation. Based on the wheel detector indications, the cut routing controller performs a directional-type axle count and vacancy detection. This ensures that points are only thrown when they are clear and not bridged by overlong cars. The points are thrown as early as possible in order to allow the timely introduction of countermeasures, e.g. automatic reversal of a set of points which does not reach its end position, in the event of irregularities.

The cut routing controller also offers the option of diffusing dangerous situations by setting trap points with clearance, thus keeping succeeding cuts away from dangerous areas. This is the responsibility of the following system functions:

- early detection of bad runners
- cut monitoring
- “vehicle stationary” monitoring
- detection of impermissible wheel detector indications

The trap points can be requested by the cut routing controller and all other controllers within the system (e.g. retarder controllers).

Marshaling yard interlocking included

One system – double the benefits

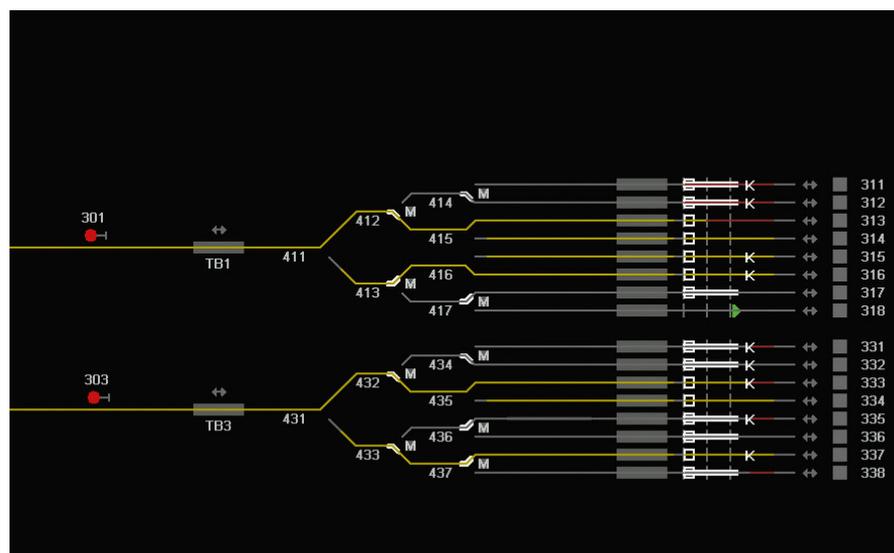
The cut routing control microcomputer can also be used to set shunting routes. The number and the path of the shunting routes are freely configurable.

This means that several shunting routes can be set simultaneously, provided they do not cross and are clear of one another. Shunting routes are usually released automatically in sections after being traversed.

If a shunting route is set in the opposite direction, the computer automatically releases partial routes which have not been traversed and have therefore not been released yet. The traffic control staff can, however, also release the shunting routes manually.

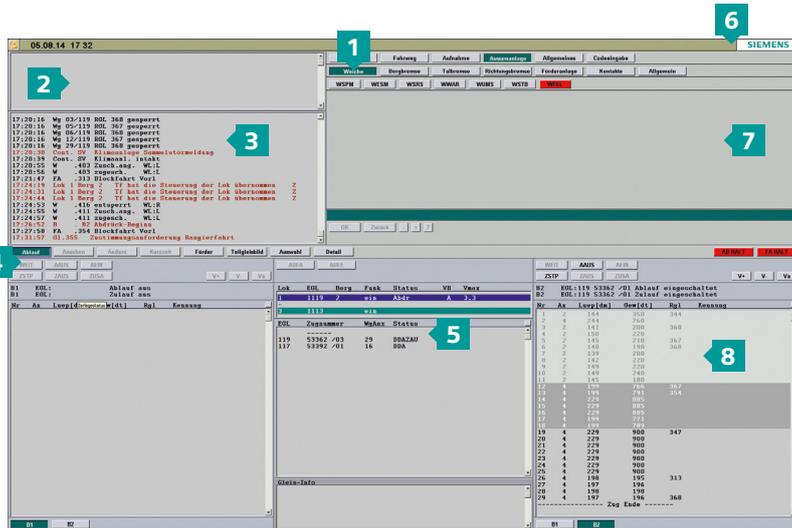
These functions enable the control of any number of shunting movements in the classification zone or other marshaling yard areas. Trackguard Cargo MSR32 can thus be implemented as an inexpensive marshaling yard interlocking.

In this case, the ABAS graphical user interface continues to be used. The track diagram and operating monitors, however, are combined into one device.

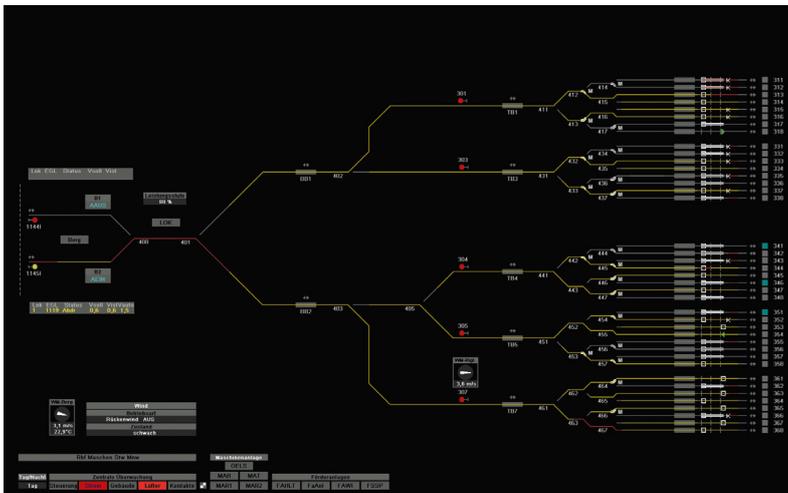


Division of the ABAS operating monitor

Optimum overview at all times

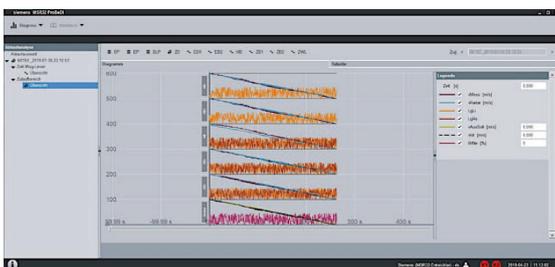


1. Window switchover menu
2. Logging window: list of operator actions
3. Indication window: list of operating and fault indications
4. Window switchover menu: switches between cut lists and train overview windows, track diagram or cut list display
5. Train overview window: overview of trains on arrival tracks
6. Header: date, time, logo, computer connection
7. Operator control window: operator action menu bars, request for associated parameters
8. Cut list window for hump 1 + 2: contains data for trains with activated automatic control

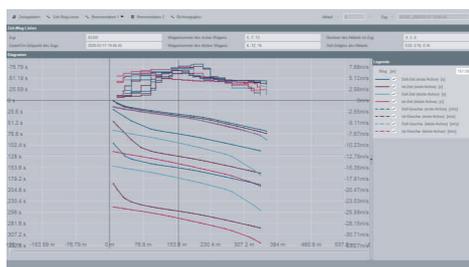


Track diagram monitor for object-oriented operator actions

Examples of screen views of the maintenance and diagnostic system



Humping analysis (feeder area)



Humping analysis (time/distance curves)

Trackguard Cargo MSR32: precise, reliable and successful

Flexible technology – the answer to increasing requirements

**Speed control
Time-optimized through the
classification zone**

Speed control ensures the optimally timed retarding of humped cars without damaging freight. Hydraulic clasp retarders of the Trackguard Retarder type are generally used for retarding. Depending on the yard size and automation level, one to three retarder groups (upper main retarders, lower main retarders and classification track retarders) are installed. The BKINA (retarding deceleration dependent on the kinetic energy to be dissipated) procedure which is used for all retarder controllers guarantees optimum retarding and a high level of accuracy.

Upper main retarders and lower main retarders are controlled in such a way that the entry speed of the cars into the next retarder group does not exceed the maximum permissible speed and that the distance between cars necessary for point throwing is always ensured. Different running times of good and bad runners are equalized.

If the hump yard is not equipped with classification track retarders, the lower main retarder is controlled using the procedure of "automatic lower main retarder control for brakeman mode". In this way, the entire hump yard can be controlled by just one person. The cut routing control operation and display system is used for all displays and operator actions.



In addition, automatic lower main retarder control significantly improves shunting quality. Due to consideration of the running qualities, a high level of accuracy is achieved on the classification track when complying with the speeds calculated. This makes the brakeman's task easier, improves quality and also results in a high classification track occupancy level.

The control procedure for the classification track retarders depends on the required humping performance of the overall yard. If the yard has clearance and closing-up propulsion equipment, retarding is down to a constant release speed of between 1.25 and 1.5 m/s.

In medium-capacity hump yards, classification track retarder control in line with the target-shooting procedure provides the most economical mode of full automation. The cuts are retarded in such a way that they reach their target – usually the last car on the classification track – without exceeding the permissible impact speed.

Variable nominal release speeds are also achieved by a combination of the target-shooting procedure and closing-up propulsion equipment. The propelling trolley's starting position can be varied on the classification track for energy optimization.

Propulsion equipment

High-tech for the optimum

In high-capacity yards, clearance equipment is responsible for the immediate removal of long cuts from the last set of classification points and the danger zone behind the classification track retarders. Closing-up propulsion equipment pushes cars into the exact position for coupling on the classification track.

The driving engines of both propulsion systems are supplied by frequency inverters which are controlled by inter-mediate circuits. This ensures optimum efficiency of the overall system, since only the energy required for the current propulsion action is supplied. In retarding and reversing procedures of the propelling trolley, energy is fed back into the intermediate circuit.

In addition, the dynamic response of variable-frequency-supplied engines reduces wear and leads to longer service lives of the winding cable and driving units. The applied torque/speed control ensures ultra-precise compliance with the propulsion speeds and avoids catapult effects.

Only one closing-up propulsion unit per track is used with variable starting positions for the clearance target-shooting and propulsion procedure.

Gradient compensation retarders

Automation on the classification track

As far as possible, track work is avoided in economical yard planning. The generally existing down gradient is compensated by gradient compensation retarders to ensure that there is no impermissible acceleration of heavy cuts. The MSR32 controller achieves optimum speed control of cuts on the classification track.



Remote control of locomotives

Faster over the hump

In contrast to a system with manually controlled humping locomotives, humping performance can be increased by at least 20 % with remote control of the humping locomotive for the hump approach and humping operation.

At the start of the humping operation, the maximum permissible humping speed is calculated for each cut. This process takes account of track parameters, the routes and the properties of the cuts.

The humping speed calculated in this way for each cut is continuously transmitted by radio to the humping locomotive and automatically applied by the latter to the individual cars. The humping speed is thus constantly and optimally adapted to the humping behavior of the cars and cuts. Despite increased humping performance, this results in another considerable reduction in the risk of wrong runners and corner impact.

Logging

Fault location made easy

The Trackguard Cargo MSR32 system's comprehensive logging functions ensure that maintenance staff can retrace all events, evaluate them and respond early to irregularities. All operator actions, responses to operator actions and indications of irregularities are recorded, in addition to all events on the process control level, such as process inputs and outputs. The microcomputer activities of all controllers can thus be retraced later and any possible events can be localized quickly.

Logging the retarding operations of all retarders enables constant monitoring of their status and thus targeted maintenance. A remote diagnostic unit which can be interfaced via suitable access is installed at Siemens.

Maintenance and diagnostics

Data makes it possible

The MSR32 hump control system includes an independent maintenance and diagnostic system with various functions.

The maintenance and diagnostic system continuously captures data from the active system, which is then used as a data basis for the diagnostic, maintenance and statistical functions.

Further useful functions, such as the adjustment of selected configuration data of the active system and the digital provision of system documentation, are also available.

A mobile application makes it possible to use the system documentation at the scene of the incident and to operate the retarders for the maintenance personnel and to carry out reaction time measurements.

Further mobile operating options are in preparation.





Trackguard Cargo MSR32 TB kompakt lower main retarder controller

High-performance retarder controller for
automation of lower main retarders

Sophisticated technologies are essential for state-of-the-art operations and efficient utilization of a marshaling yard. With the modular Trackguard Cargo MSR32 TB kompakt lower main retarder controller, Siemens has developed a reliable, safe and economical solution. It is the first step towards a fully automatic marshaling yard. Due to the modular system structure and ease of integration into the MSR32 system family, the possibilities for modernizing marshaling yards are unlimited.

Benefits of Trackguard Cargo MSR32 TB kompakt

- Modular, open microcomputer system for controlling lower main retarders (gradual extension up to high-capacity yards)
- Later integration into the MSR32 hump control system (cut routing control)
- Option of connection to gravity classification interlockings (e.g. ADrS 60)
- Low maintenance and repair requirements
- High shunting quality
- Reduction in shunting damage
- Installation, modification and commissioning of systems while in service possible, without delays to normal operation (no track possessions*)
- Integration into modern information systems (cargo management system)
- Individual or turnkey technical solutions from planning to implementation

Scope of functions

Speed control

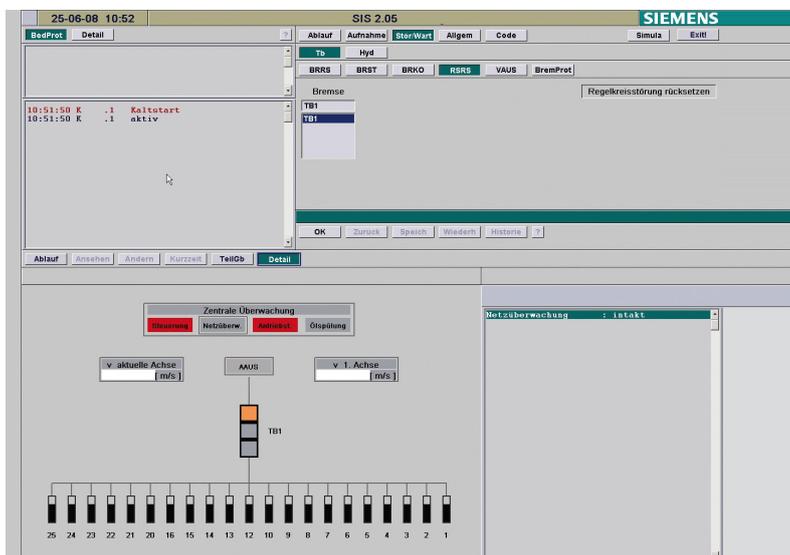
Automatic retarder control of up to four lower main retarders in accordance with the established physical properties of the humped cars and the route, taking into consideration the destination track occupancy level. A solution involving semi-automatic speed control with specification of the target release speed by the operator is also an option.

Gravity classification interlocking control in relay technology included

Connection to an existing gravity classification interlocking in relay technology (e.g. ADrS 60) makes cut routing control via Trackguard Cargo MSR32 TB kompakt possible (with ADrS 60, switching-zone code activation). This involves using a PC to enter the cut data and the destination track information, or automatically read the cut data and destination track information via a terminal planning or train announcement system. Technical dependencies (e.g. upper main retarders, automatic operation from and to Track-guard Cargo MSR32 TB kompakt) exist as a standard feature.

Availability

Failures of individual components are detected and bypassed by substitute actions until they have been cleared. The use of dual-computer systems increases the availability still further – ensuring round-the-clock operability.





Integration into the overall network

The lower main retarder controller is one link in a transport chain (line, terminal planning systems, marshaling yard interlocking, etc.). Track-guard Cargo MSR32 TB kompakt is capable of exchanging data with higher-level cargo management systems for the purpose of handling humped cars (cut data from train announcement).

** MSR32 – microcomputer system from Siemens for marshaling yard operations based on 32-bit processors*

Ergonomics

The man-machine interface consists of a PC with a graphical user interface. Simple mouse clicks and online help functions enable the entire process to be controlled and displayed. The option of semi-automatic lower main retarder operation via a control desk is also available.

Data archiving

All the data generated during the process (process signals, operator actions and responses, information concerning handled cuts) is stored by means of a logging system with the date and time (on a scale of a few milliseconds) and can be edited and printed out using tools on the service and diagnostic PC. This enables all the activities of the controllers to be retraced and preventive maintenance measures to be implemented.

Operator control level

LAN

Control level

The TBK control cabinet comprises:

- lower main retarder controller (TB K-ST)
- interface equipment
- communication computer (TB K-K)

Printer



Outdoor equipment



Light curtain



Radar



Retarder



Machine system



Weight sensor



Double wheel detector

Technical equipment of Trackguard Cargo MSR32

- Siemens microcomputers networked via a LAN
- Real-time multitasking operating system for process control, application software based on standard programming languages
- Windows-based graphical user interface with mouse control, flat screen or monitor as the man-machine interface (MMI)
- Track vacancy detection using low-cost wheel detectors (proximity switches)
- Doppler radar devices for speed and length measurement
- Light grids (light curtains) for detecting the space between car cuts
- Weight sensors for determining axle loads (bending torque evaluation) directly at the rail
- GPS-based timer
- Interface to higher-level terminal planning systems via Interface-Server
- Technical signal-interlocked functions
- Interfacing option with Interface-Server
- Control of hydraulic/electrodynamic retarders

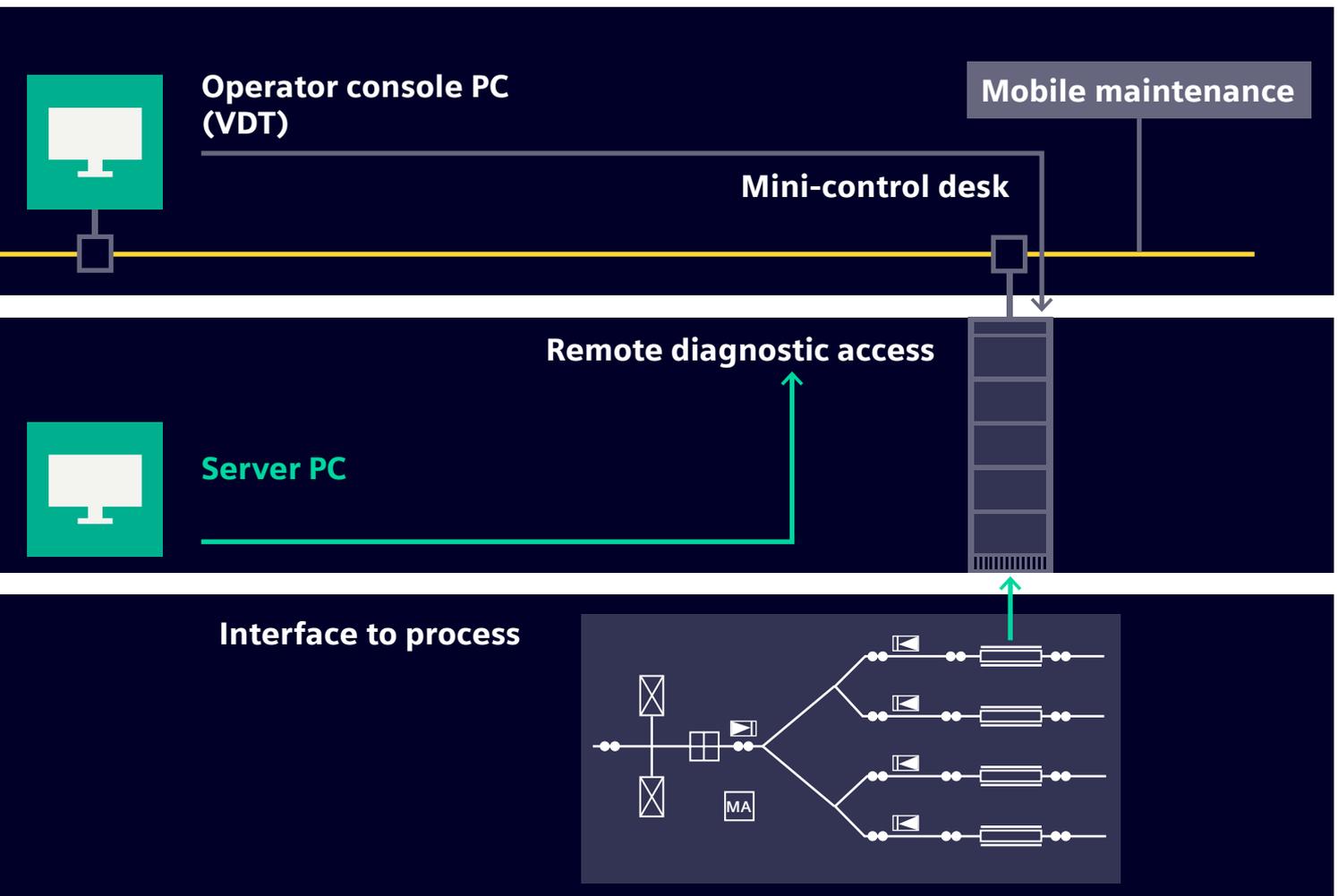
- Lightning and overvoltage protection modules against induced over-voltages from the outdoor equipment

Standards

- EMC certificate in accordance with CE standards EN 50081-2 and EN 50082-2 (the requirements from ENV 50121-4 are also covered)

Our services

- Interactive analysis of demands and local consultation
- Operations simulation with suggestions for optimization
- Professional project management
- Customization, enhancements based on customer requests
- Training
- Set-up and pretesting of the system in Braunschweig (testing using operation simulators)
- Installation and commissioning
- Operations support in the start-up phase
- Maintenance/support (hotline)
- Operations management



Our success factors

- Customer proximity
- Technical competence with over 30 years of experience in marshaling systems
- Flexibility
- Quality
- Mature technology (used in many marshaling yards in Europe)

Its high-level functionality and flexibility, excellent quality, expert service, and market presence around the world are indicators that show that Track-guard Cargo MSR32 TB kompakt is a powerful, reliable system. Siemens has incorporated its decades of experience in the field of marshaling systems into the development of Track-guard Cargo MSR32 TB kompakt and designed it to meet the latest technical standards.

The Trackguard MSR32 TB kompakt lower main retarder controller has been practice-proven and is used – in its different versions – by all kinds of railway operators throughout Europe.

As a result of the great flexibility of the controller, there are no limits to its application worldwide. The economic efficiency and performance of the facilities in use testify to successful application of the Trackguard Cargo MSR32 TB kompakt lower main retarder controller under harsh marshaling yard conditions. Competent and efficient service from Siemens helps to point the right way for future rail operations in good time.

Siemens Mobility GmbH

Otto-Hahn-Ring 6
81739 Munich
Germany

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