EKE

SIL Safety Applications

Smarter trains. Better future.

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EKE-TRAINNET®
SIL SAFETY PRODUCT FAMILY

AT EKE-ELECTRONICS, WE PRIDE OURSELVES ON OUR EXTENSIVE EXPERTISE IN DESIGNING AND MANUFACTURING SYSTEMS WITH SAFETY INTEGRITY LEVEL FUNCTIONS. WITH A PROVEN TRACK RECORD, WE HAVE SUCCESSFULLY DEVELOPED SYSTEMS UP TO SIL 2 FOR A WIDE RANGE OF SAFETY-CRITICAL FUNCTIONS.

PROVEN TRACK RECORD

At EKE-Electronics, we boast a proven track record of developing systems up to SIL 2 across diverse safety functions.

Leveraging our wealth of experience and a comprehensive process adhering to standards such as EN50126/50128/50129, we have established a robust framework for developing and testing safety applications.

With a large number of existing functionalities already developed, coupled with rigorous testing and documentation practices, our capabilities are unmatched in the industry, affirming our ability to deliver safety-critical solutions up to SIL 2 with utmost reliability and confidence.

WHAT DO WE OFFER?

EKE has in-house competencies to develop a range of safety applications. Below is a selection of some of our offerings. We have developed many more, so please contact us to learn how we can assist with your specific needs.

AUTOMATIC SELECTIVE DOOR OPERATION
Automatically assesses the train's alignment with the station and platform setup, granting activation solely to doors that can be safely opened. RIS-2747-RST.

HOT AXLE BOX DETECTION
Continually monitors the axle box and gearbox temperature and issues warnings if the measurements vary from normal. EN 15437-2.

LATERAL ACCELERATION MONITORING
Measures lateral vibrations and sends notifications about abnormalities or automatically stops the train in immediate danger.

VIGILANCE CONTROL SYSTEM
Continually monitors the train driver's vigilance and automatically stops the train if the system pedal/button is not periodically pressed.

PHYSICAL PREVENTION OF OVERSPEEDING
Speed-monitoring system. Automatically brakes, stops tram, and alerts control room on limit breach.

AUTOMATED PANTOGRAPH CONTROL
A change-over function which provides location-based control for switching power feed from the catenary to battery.

SAFETY COMMUNICATION MANAGEMENT SYSTEM
Centrally managed networked safety functions to ensure safe data communication throughout the train.

SUPERVISION OF TRACTION ENABLING
Checks conditions that must be fulfilled to enable the traction, e.g. driver's cab occupied, no speed (null speed signal on), doors are closed.

FIRE DETECTION SUBSYSTEM MONITORING
Reads fire detection signals from locomotives and coaches and displays the information to the train crew.

SUPERVISION OF PASSENGER ALARM ACTIVATION
Receives the activation of the passenger alarm when the train is at the platform or when leaving the platform.

TRAIN SPEED AND DISTANCE MONITORING
Analysis of several speed measurements and display of the value to the train crew.

BRAKE PIPE PRESSURE MONITORING
Informs the driver of the status of the main brake pipe pressure and if necessary, activates the protective actions.

AUTOMATIC SELECTIVE DOOR OPERATION

ENSURE A SAFER AND MORE COMFORTABLE TRAVEL EXPERIENCE BY CONTROLLING DOORS INDIVIDUALLY INSTEAD OF BY COACH OR CAR. THIS ALLOWS FOR PRECISE DOOR MANAGEMENT, ESPECIALLY IN STATIONS WITH SHORTER PLATFORMS.

WHAT IS ASDO?

Automatic Selective Door Operation (ASDO) automatically controls train doors at each station stop by checking train location and platform configuration to ensure only safe doors open, improving passenger safety and comfort.

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WHY CHOOSE EKE?

Benefit from our unparalleled expertise, backed by the successful installation of over 2,000 ASDO systems across multiple countries. Our extensive experience ensures reliable performance and exceptional quality, making us the trusted choice for efficient and safe door operation solutions.

01

SIL SAFETY CAPABILITY

Leveraging our wealth of experience and a comprehensive process adhering to standards such as EN50126/50128/50129, we have established a robust framework for developing and testing safety applications. Customers can be assured of a dependable solution that prioritises safety without compromising on performance.

02

SEVERAL POSITIONING SOLUTIONS

We offer multiple ASDO options to address diverse needs: ASDO utilises odometry with GNSS, balises/beacons and odometry. This flexibility allows us to adapt to various operational scenarios, recognising our customers' unique preferences and constraints.

03

ABILITY TO RETROFIT TO LEGACY TRAINS

Our ASDO solution retrofits older trains, extending their lifespan and integrating new door safety solutions without the need for a new door system or requiring new train purchases. This can be part of fleet modernisation/refurbishment programmes.

ASDO can also be used as part of the European Train Control System (ETCS).

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WHAT DO WE OFFER?

ASDO includes a comprehensive range of features designed to enhance the efficiency and safety of your operations, with additional options like the ASDO Visualisation Tool and variants available to further tailor the system to your needs.

ASDO STATION DATABASE

The ASDO solution includes the ASDO Station Database, containing essential infrastructure details like stations and platforms. This database builds the "station network" for ASDO usage and can be easily updated by operators to reflect changes such as track renewals, new routes, or stopping patterns.

For traceability, the database has its own version control system, allowing operators to verify the current version directly from the ASDO HMI maintenance screen.

ASDO VISUALISATION TOOL

The ASDO Visualisation Tool enhances the functionality of the ASDO Station Database tool by introducing an interactive map feature. This feature allows users to visualise various objects within the ASDO Station Database, including Stations, Reset Points, and Segments.

The tool offers a user-friendly graphical interface that simplifies the process of editing the ASDO Station Database. This interface utilises OpenStreetMap Online for seamless navigation and editing capabilities.

VARIANTS OF ASDO

EKE offers the following variants of ASDO:

- **Selective Door Operation**: The crew manually selects the doors that can be safely opened.
- **Correct Side Door Enabling:** A train door control system that ensures the train doors open on the correct side of the train at each station platform. This is important for passenger safety and comfort, as passengers need to be able to easily access the train without having to cross over the tracks.

HOW DOES IT WORK?

The ASDO system begins by verifying the platform configuration to ensure that doors open only at the correct locations. It uses odometry, in conjunction with GNSS and data from the ASDO Station Database, to locate the train and identify the station. This information determines the number of doors to open and on which side(s) of the train. If necessary, balises or beacons can also be utilised.

1. **ASDO determines train location:** Position calculated from odometer, GNSS or given by balises/beacons.
2. **Driver stops the train at the correct position:** The driver is responsible for stopping the train at the correct sign.
3. **ASDO enables door opening:** The determined train location is crossed with the station configuration database stored in ASDO. The doors which are safe to open are identified.
4. **Driver/guard releases the doors:** ASDO informs the crew about the doors to be enabled by ASDO via the ASDO HMI display.
5. **Exception:** In exceptional circumstances, the crew may override the ASDO door pattern.

Automatic Selective Door Operation

In case no location information can be obtained, a list of stations and platforms is presented to the crew. They can manually select the location of the train and appropriate doors will be enabled for opening. The most logical station is suggested first.

HOT AXLE BOX DETECTION

AN ON-BOARD HOT AXLE BOX DETECTION SYSTEM ENABLING CONTINUOUS MONITORING TAILORED TO SPECIFIC TRAIN CHARACTERISTICS, TRIGGERING ALARMS FOR ANY DEVIATIONS FROM ACCEPTABLE TEMPERATURES, AND ENSURING TIMELY SAFETY MEASURES ARE IMPLEMENTED.

WHAT IS A HOT AXLE BOX DETECTION SYSTEM?

A hot axle box detection (HABD) system is a device used to monitor the temperature of the axle boxes on train wheels and/or gearboxes to check for overheating bearings, which could potentially lead to mechanical failures or even fires. These can be wayside or on-board systems.

WHY CHOOSE EKE?

The on-board Hot Axle Box Detection system offers real-time, configurable solutions for different train types and designs. With over 1,800 HABD systems installed, you can rely on our extensive experience and trusted performance to ensure optimal safety and efficiency for your fleet.

01

ON-BOARD CONTINUOUS TEMPERATURE MONITORING

On-board continuous temperature monitoring for hot axle boxes provides superior bearing condition insights over traditional trackside equipment. Unlike intermittent trackside measurements, on-board systems deliver constant real-time data. Monitoring both wheel and gearbox temperatures offers a comprehensive view of axle health, allowing early failure detection and improved safety.

02

MONITORING REGARDLESS OF AXLE BOX LOCATION

Unlike traditional wayside detection methods, which are limited to monitoring axle boxes located on the outside of the wheels, the system seamlessly integrates into the train itself, ensuring comprehensive surveillance of all axle points. This ensures that potential issues, such as overheating, are detected immediately, regardless of axle box location, reducing the risk of costly equipment failures, minimising downtime, and safeguarding your operations.

03

CONFIGURABLE, EFFICIENT MONITORING SOLUTION

Our monitoring system's versatile sensor compatibility and flexible configuration allow precise customisation to meet unique customer needs and operating conditions. This tailored approach improves detection accuracy and effectiveness. It accommodates various train models, bogie designs, and bearing properties, providing a bespoke, efficient solution for railway operators.

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WHAT DO WE OFFER?

The Hot Axle Box Detection system enhances safety, reliability, and operational efficiency in railway operations, instilling confidence in the monitoring system and ensuring the uninterrupted flow of rail traffic.

FULLY REDUNDANT SYSTEM

The Hot Axle Box Detection system is a fully redundant system ensuring the highest level of reliability and safety in railway operations. Redundancy involves incorporating multiple independent sensors and backup components that continuously monitor the axle box temperatures.

In the event of a sensor failure or any other malfunction, the redundant system seamlessly takes over without interrupting the monitoring process. This setup guarantees that there is no single point of failure, significantly reducing the risk of undetected issues.

CONFIGURABLE ALARM LEVELS

Configurable alarm levels are essential to enable tailored safety responses that enhance train operations. Operators can set specific temperature thresholds based on various factors like train types, bearing properties, and operational conditions.

Customising these levels allows the system to accurately detect abnormal temperature rises, signalling potential bearing failures. This optimisation ensures each train receives appropriate monitoring and intervention, thus enhancing safety and reliability across diverse rail networks.

AUTOMATIC ALARMS AND ACTIONS

The system is equipped with preset temperature ranges, automatically triggering an alarm if deviations occur. This enables timely interventions to prevent accidents or disruptions.

In addition to alarms, the system can take immediate actions, like triggering the train emergency stop. Taking immediate action not only prevents potential accidents but also minimises disruptions to rail operations.

HOW DOES IT WORK?

The Hot Axle Box Detection system is an essential safety feature in railway operations, designed to monitor and prevent overheating in axle boxes and gearboxes. The system operates through a series of precise steps:

1. **Temperature sensors:** Sensors measure the axle box and gear box temperatures.
2. **Calculate average temperature:** The temperature is measured ten times per second. The ten second average is used for calculation.
3. **Assess the temperature level:** The temperature is assessed to determine if it has crossed one of the four thresholds.
4. **Alarm or action:** A notification is issued if the temperature has exceeded one of the four thresholds either giving an alarm or to undertake a given action such as triggering the train emergency stop.

EKE-Trainnet® System including Hot Axle Box Detection System

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LATERAL ACCELERATION MONITORING

AN ON-BOARD MONITORING SYSTEM DETECTING ABNORMAL LATERAL MOVEMENTS IN REAL-TIME, THEREBY ENHANCING PASSENGER COMFORT, REDUCING INJURY RISKS, AND FUNCTIONING AS A PREDICTIVE MAINTENANCE TOOL

WHAT IS LATERAL ACCELERATION MONITORING?

Lateral acceleration monitoring (LAM) on trains involves measuring the lateral forces experienced by the train as it moves along the track, allowing for the assessment of the train's stability and adherence to safety parameters during curves, switches, or other track conditions that may induce lateral forces.

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WHY CHOOSE EKE?

EKE are dedicated to delivering top-tier technology that prioritises passenger safety and operational efficiency. Our predictive maintenance system detects abnormalities early, ensuring uninterrupted service. With tailored solutions, we empower you to deliver exceptional service and build trust in your brand.

01

TECHNICAL EXPERTISE AND COMPLIANCE

Drawing on our expertise in safety-critical functions and compliance, our Lateral Acceleration Monitoring system stands as a trusted choice for the rail industry. Adhering to safety integrity levels (SIL) and industry standards like EN 50126/50128/50129, we assure customers of our product's reliability and robustness. This underscores our commitment to technical excellence and regulatory compliance, giving you a competitive edge in the market.

02

CUSTOMER-CENTRIC APPROACH

At the core of our Lateral Acceleration Monitoring system is a profound understanding of your unique needs and priorities. With our modular approach, we tailor solutions to directly tackle your specific pain points and challenges. This ensures that you can consistently deliver exceptional service to your customers, cultivating trust and loyalty in your brand. Our system is not just about monitoring—it's about empowering you to excel in every aspect of your operations.

03

PREDICTIVE MAINTENANCE

By detecting abnormalities before they become safety risks, our system ensures uninterrupted service and passenger comfort. Moreover, with its capability to provide valuable insights into wheelset conditions and track damages, you gain the advantage of enhanced maintenance planning.

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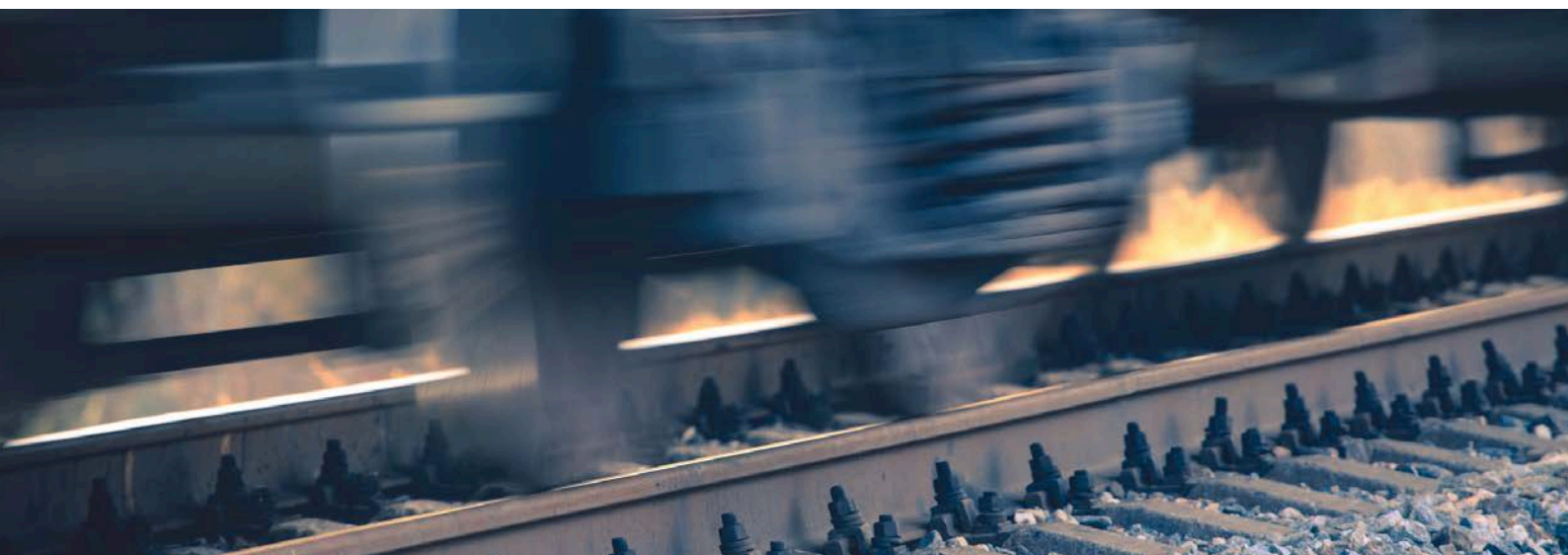
WHAT DO WE OFFER?

Lateral Accelerator Monitoring enhances safety, reliability, and operational efficiency by enabling prompt hazard detection, proactive maintenance, and uninterrupted surveillance, optimising rail network performance.

CUSTOMISABLE ALARM LEVELS

Operators have the flexibility to configure multiple levels of alarms customising them to suit specific safety thresholds or operational preferences.

The system's customisable alarm settings ensure that operators receive timely alerts tailored to their unique requirements.

This empowers operators to proactively address potential safety risks and optimise operational efficiency based on their specific needs and priorities.

REAL-TIME DATA PROCESSING

The Lateral Acceleration Monitoring system captures and processes data in real-time, following industry-standard methods like those in UIC 518:2009.

This capability enables swift analysis of lateral acceleration values, empowering operators to promptly make informed decisions.

By monitoring and analysing vibrations continuously, operators can address safety concerns and optimise operations in real-time, ensuring seamless operations and enhancing safety, efficiency, and reliability across their rail networks.

DESIGNED WITH REDUNDANCY

Redundancy can be built into the Lateral Acceleration Monitoring System, further enhancing its reliability.

Redundancy ensures that even in the event of a sensor failure or system malfunction, there are backup mechanisms in place to continue monitoring lateral vibrations effectively.

Redundancy minimises the risk of missed detections and ensures continuous monitoring, contributing to the overall safety and reliability of rail operations.

HOW DOES IT WORK?

Accelerometers are placed in the axle box and on the car body. As the train travels, the vibrations measured by these sensors are processed. Should these vibration measurements trigger the threshold values, an alarm is set.

1. **Measurement:** Accelerometers are placed in the axle box or on the car body.
2. **Convert:** The vibrations measurements are converted into lateral acceleration values, providing quantifiable data on the train's lateral movement.
3. **Assess:** The lateral movements are assessed to determine if they have exceeded the criteria for acceptable lateral accelerations.
4. **Alarm set:** An alarm is set to either notify maintenance teams about abnormalities or even automatically stop the train in case of immediate danger.

EKE-Trainnet® System including the Lateral Acceleration Monitoring System and Hot Axle Box Detection System

VIGILANCE CONTROL SYSTEM

CONTINUOUS MONITORING OF TRAIN DRIVER VIGILANCE FOR ENHANCED PASSENGER AND TRAIN SAFETY. ALSO KNOWN AS THE DEAD MAN'S SWITCH OR DRIVER SAFETY DEVICE.

WHAT IS A VIGILANCE CONTROL SYSTEM?

A vigilance control system (VCS) is a safety mechanism designed to monitor the alertness of train operators. Also recognised as the Dead Man's Switch or Driver Safety Device (DSD). Should the driver fail to react to the alert system, a series of actions are initiated, finally resulting in the train being stopped automatically.

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WHY CHOOSE EKE?

EKE's Vigilance Control System extends beyond basic monitoring capability, offering a range of customisable features and the flexibility to meet your specific needs.

01

MONITOR A RANGE OF ACTIONS

The normal operation of the Vigilance Control System is that the driver presses onto a pedal or dedicated momentary push button. However, the Vigilance Control System can monitor other actions, ensuring thorough vigilance and adaptability based on your specific needs.

02

ADDITIONAL INPUT/OUTPUT CHANNELS

The modularity of the system allows you to add as many input and output channels as you wish, by simply adding new modules and/or choosing a larger rack.

With additional input/output channels, it seamlessly integrates with your existing infrastructure, providing enhanced functionality.

03

FUNCTION AS AN EVENT RECORDER

The Vigilance Control System can also function as a reliable event recorder, capturing critical information about the sequence of events leading up to any operational incidents or emergencies. This capability allows for detailed retrospective analysis, enabling operators to review and understand the circumstances surrounding specific events.

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WHAT DO WE OFFER?

The Vigilance Control System boasts a variety of features designed to easily tailor the system to meet specific operational requirements and preferences.

ADJUSTABLE TIMINGS

Adjustable interval timings enhance both safety and flexibility. Customising these intervals allows operators to align vigilance checks with specific operational needs, reducing false alarms and unnecessary interventions.

This adaptability ensures optimal responsiveness to varying conditions, improving efficiency, and minimising disruptions while maintaining high safety standards for passengers and crew.

CUSTOMISABLE ALARM LEVELS

By adjusting alarm levels, operators can set alert thresholds to match specific operational needs and environmental conditions, ensuring timely and relevant notifications.

This customisation minimises unnecessary alarms, reducing distractions for the driver and allowing for better focus on critical tasks.

Ultimately, this flexibility results in a more efficient and responsive safety system, contributing to improved overall safety and reliability for passengers and train operations.

### MODIFY THE MINIMUM SPEED THRESHOLD

This feature allows operators to tailor the system's activation criteria to suit specific operating conditions, ensuring that vigilance checks are only triggered when the train is operating above a certain speed threshold.

By customising the minimum speed threshold, operators can minimise unnecessary activations during low-speed manoeuvres, reducing the likelihood of false alarms and driver distractions.

HOW DOES IT WORK?

The Vigilance Control System activates upon the train driver signalling their vigilance by engaging a pedal or dedicated button. A predefined schedule, denoted as T1, T2, and T3, dictates the intervals at which the driver must signal their vigilance and specifies the subsequent actions if there is no response.

1. **System activated:** The system is activated when the train is operating above 10 km/h.
2. **Vigilance notification:** The driver must press a button or pedal.
3. **Alarm light:** If there is no activity after T1, the alarm light blinks.
4. **Alarm bell:** If there is no response within T2, the alarm bell rings.
5. **Emergency brake:** If no response within T3, the emergency brake is applied. Automatic braking also engages if the Vigilance Control System loses power.
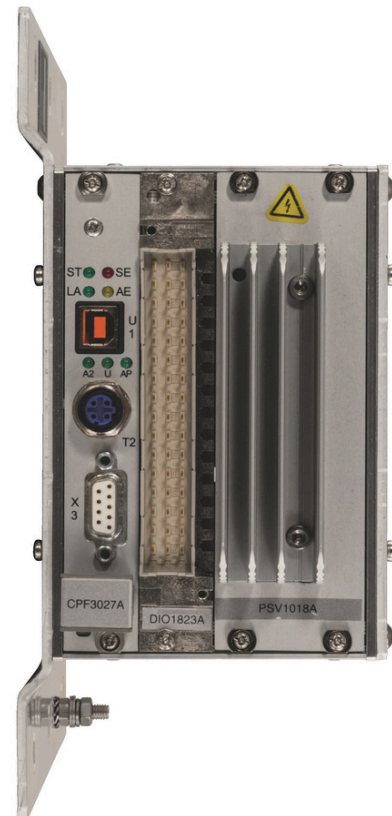
Vigilance Control System in flat rack with CAN interface module and extra logging memory

OTHER SAFETY SOLUTIONS

IN COLLABORATION WITH SELLA CONTROLS, WE HAVE DEVELOPED TWO SAFETY APPLICATIONS FOR LIGHT RAIL.

PHYSICAL PREVENTION OF OVER-SPEEDING

The Physical Prevention of Over-Speeding (PPOS) system prevents trams from over-speeding. It allows the operator to set speed limits over the whole network by using trackside beacons and/or Global Navigation Satellite System (GNSS) together with distance measuring. The PPOS reads the speed limits from balises positioned on the tram tracks. If a tram is over-speeding, the system automatically applies service brakes, stops the tram, and sends an alarm to the Control room.

The system combines EKE's Controller with the EKE-Trainnet® Rugged Memory Module and Sella Controls' Tracklink® III Beacon and Reader. The Tracklink® III beacons are mounted transversely between the running rails, while the readers are installed on the underside of each tram. An on-board controller monitors all beacon readings and transmits data back to the control room via a 4G cellular connection or Wi-Fi.

HOW DOES IT WORK?

1. **Beacon placement:** A series of beacons are placed on the tracks, containing a speed limit and the distance to next speed zone.
2. **Continuous speed monitoring:** The tram speed is continuously monitored.
3. **Speed reading:** The beacon reader reads the speed limit from the beacon.
4. **Speed check:** The PPOS system analyses the speed information: if speed > speed limit, automatic braking is triggered.
5. **Automatic braking:** In case of automatic braking, an alarm is sent to the wayside.

AUTOMATED PANTOGRAPH CONTROL

The Automated Pantograph Control (APCO) system is used for the automated power change-over. APCO is a change-over function which provides location-based control for switching power feed from the catenary to the battery by controlling the pantograph directly or via the Train Control and Management System (TCMS).

The system is similar to the one used for the Physical Prevention of Over-Speeding but instead of checking for speed, it checks whether a change-over function is required, raising or lowering the pantograph, as required.

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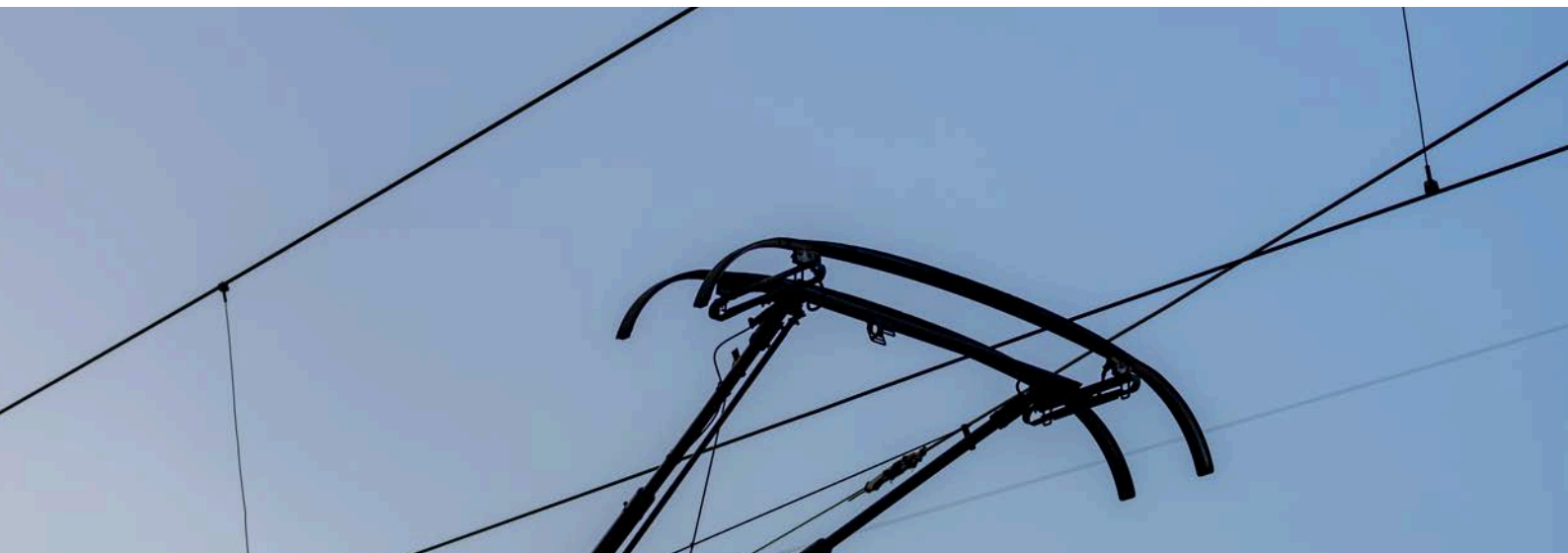
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