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Technics

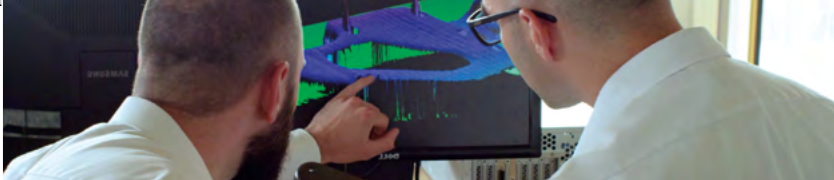
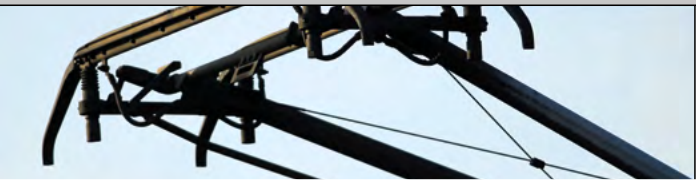
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AUTOMATED TRAIN INSPECTION

State-of-the-art Tool Analytics

Harnessing data records
to optimize
train maintenance.

We keep an eye on your train.



2 000500 999000

When it comes to train maintenance, Analytics enables you to leverage unparalleled optimization potential

Today, the volume of collected and digitally archived data increases exponentially. However, large amounts of valuable data are simply archived and their true potential remains unused.






„Big Data“ refers to data records that are too big or complex to manage with traditional data-processing methods. While big data management represents a major challenge, it also harbors enormous process optimization potential.

Analytics analyzes and utilizes large volumes of recorded data to accelerate and streamline train maintenance.

***Inspect** is the inspection system's core. When trains pass the system the train roof, sides and underbody is being inspected for problems. If any issues are found, the maintenance staff automatically receives corresponding error messages.*

***Analytics** is a self-learning, intelligent software add-on that automatically processes and analyzes the recorded data to generate added value for your business.*

Benefits of analyzing large data volumes using the automated train inspection:

 Volume	 Velocity	 Variety	 Value	 Validity
Data volume	Processing speed	Versatile data types	Added business value	Transparency and reliability

Data processing

Raw image data, relevant data of single components, measurements, related pictures, train velocity, dirt accumulations etc. – the **Inspect** core component already collects a wide variety of data that facilitates the maintenance process and makes it highly transparent.

The number of data types can be customized and prioritized as needed. Moreover, recorded data of safety-critical components and the corresponding analysis results can be grouped together to enable data correlations between raw data and analysis findings.

The data structure can also be customized according to the maintenance needs.

Gaining Valuable Insights

The greater the analyzed data volumes, the greater the insight they provide with regard to maintenance issues such as:

- Frequently missing bolts or screws, for example, in a particular location on the train roof
- The impact of dirt accumulations on component durability
- Ideal component replacement intervals to that failures or downtimes can be prevented before they happen

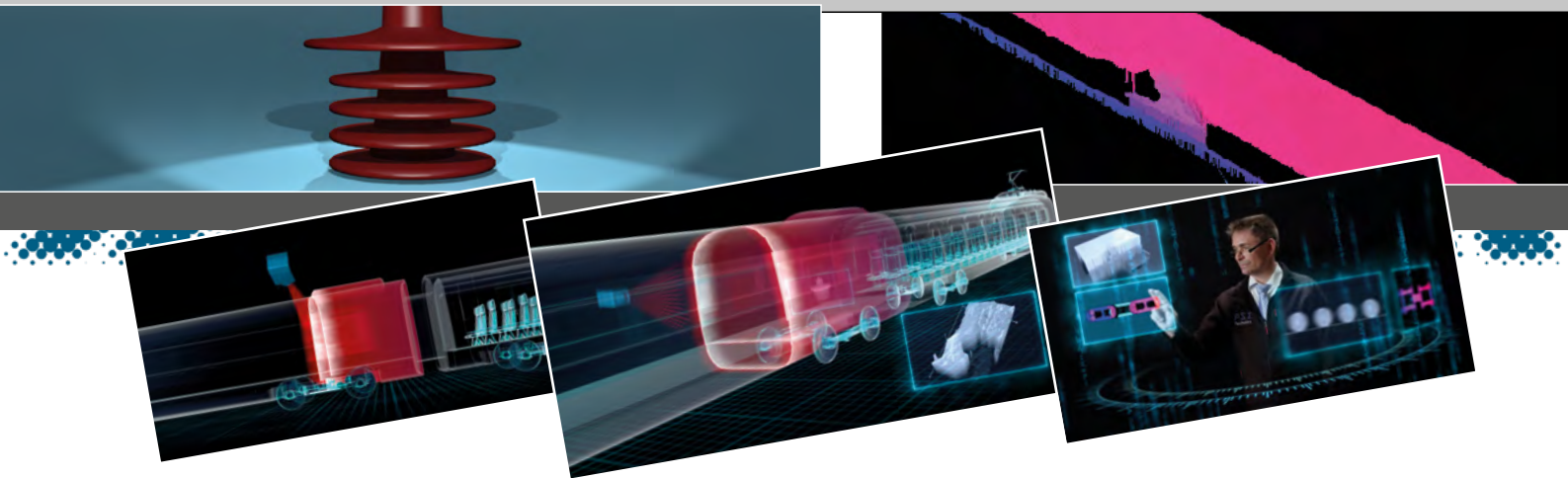
The analysis results are used to identify maintenance-related external factors or mounting problems to ensure that targeted maintenance can be carried out on both trains and tracks.

Added Value

Analytics is a state-of-the-art tool that delivers valuable information about volumes of collected data. It simplifies maintenance activities to provide maximum value.

It analyzes the collected data automatically to reveal correlations and predict optimum maintenance or component replacement intervals.

The more data is collected, the better the system “learns” to interpret potential correlations, saving valuable time and ensuring precise maintenance planning. From selecting serviceable components to ordering and stocking required spare parts: The targeted data analysis features enable train operators to minimize lead times, service times and costs.



The Automated Visual Inspection of Trains

Our engineers developed the **camera-based automated train inspection** to enable automated, condition-based maintenance for all types of rail vehicles. The visual inspection records roof, side and underbody damages of any train that passes the system, for example, when it enters a depot or drives through a dedicated “inspection tunnel”. The recorded data is send directly to the Inspect software.

OUR SERVICES

We assist you every step of the way – from concept to completion. We focus on a close cooperation with our customers to provide the right solution for your production environment. We provide an in-depth consultation, evaluate and analyze your imaging project on site. We develop prototypes for integrating the ideal camera solution and safely commission the system.

We guide you through the process, perform maintenance services to ensure that your image processing system works dependably and consistently. The benefits of industrial image processing include improved product quality and an enhanced reliability of your multiple-unit trains.

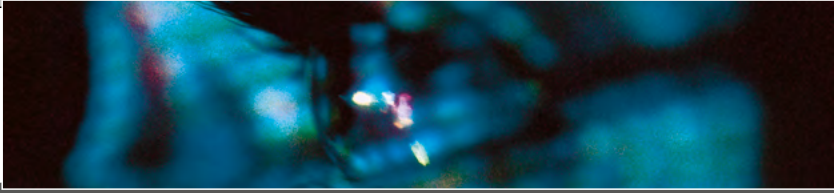
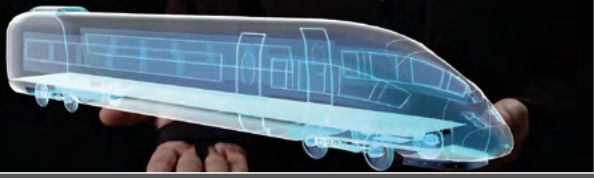
EXAMPLE ROOF-INSPECTION:

WITHOUT Automated Train Inspection	WITH Automated Train Inspection
Additional safety measures, for example, the grounding of the rail cars and the tracks are required before the visual inspection can take place.	Images of the train are automatically recorded while the train passes the inspection system.
The inspector personally examines and inspects the train for damage or wear.	The train structure is analyzed automatically. The inspector displays and checks the analysis results using a web interface.
For the time of the inspection the train occupies a track in the maintenance shop.	If the train is in good condition, it can remain in service and does not need to be transferred to the maintenance shop.
Inspection time: 1.5 hours	Inspection time: 10 minutes
The train occupies a maintenance shop track.	Thanks to the automated inspection, the maintenance shop is freed up for other maintenance-related tasks



A satisfied customer reports:

*“For us, **the automated train inspection** represents a big step towards the digitalization, automation and optimization of our maintenance processes. That data allows for additional in-depth data mining and can be used on an ongoing basis. Due to the **Analytics** machine learning component, the system offers efficient, goal-driven and preventive quality control features, which enable us to strengthen the competitive position of our railway.”*



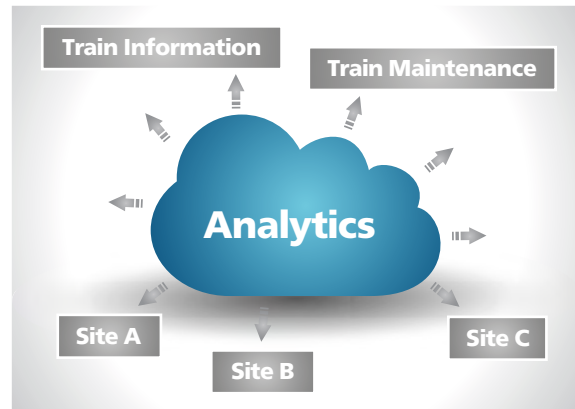
Analytics – Sample Applications

While analyzing the recorded data of each train, the inspection system generates a multitude of meaningful data. It intelligently and automatically combines recorded data to generate additional information for every train or component.

This combined data history can be incorporated into maintenance planning to enhance train availability. The Failure Probability feature helps to proactively identify and resolve any maintenance-related issues.

Machine Learning

By combining collected data with additional parameters, such as maintenance- or train-related data, train-specific analysis templates can be created to enhance **Analytics** teach-in routines.

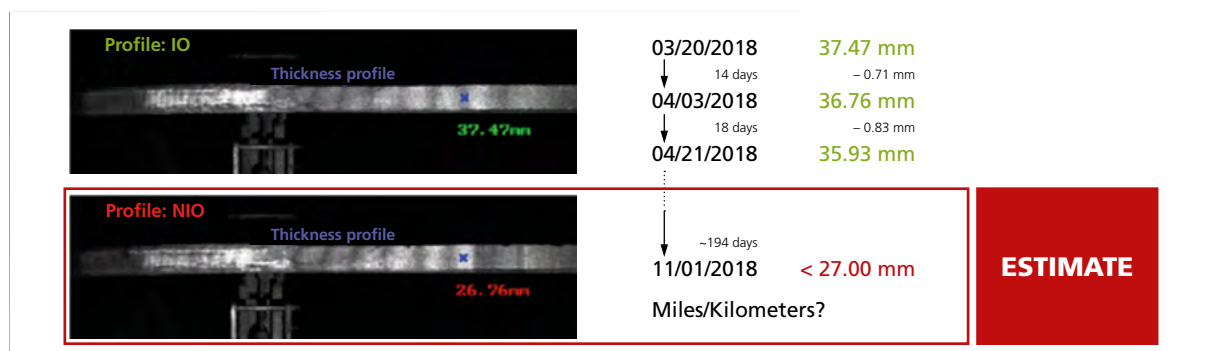


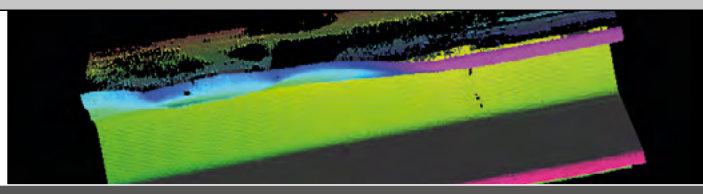
1. Predictive Maintenance: Determining the Failure Probability of Single or Critical Components

Analytics continuously analyzes newly recorded data, creating a detailed history for each component that can be used to efficiently monitor component wear.

By entering additional information, such as the number of miles or kilometers traveled since the previous analysis, progressive component wear can be predicted and the remaining component lifetime can be forecast in terms of miles or kilometers. Wear parts, such as wearing strips, can be more accurately monitored and replaced in a timely manner to protect against outages at an early stage.

Estimated wearing strip failure:





2. Process Optimization and Streamlining of Maintenance Intervals

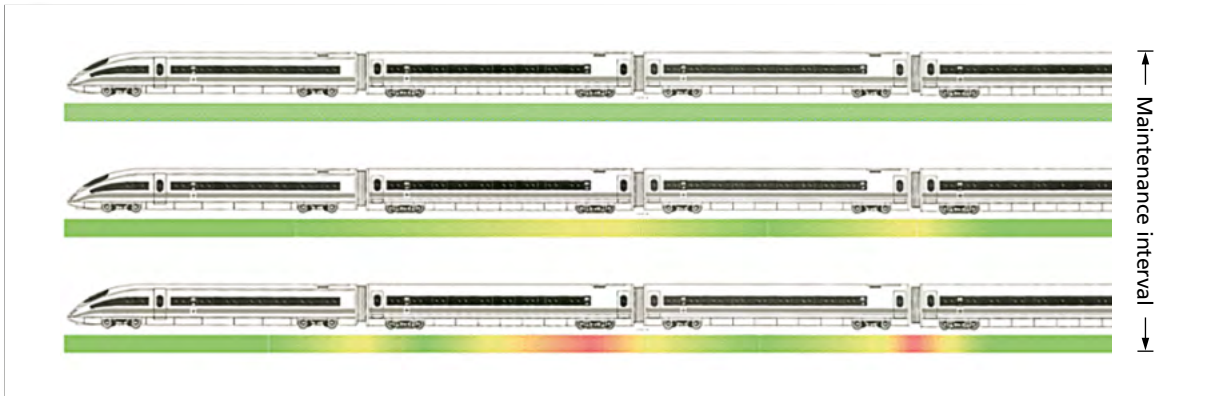
The software calculates a statistical failure probability for every single component. These calculations can be used to optimize maintenance intervals based on component wear.

The accuracy of the predicted maintenance intervals increases based on volume of analyzed data. Additional information, such as traveled distances (miles/kilometers) can be included to improve the accuracy even further.

Failure probability until the next maintenance interval

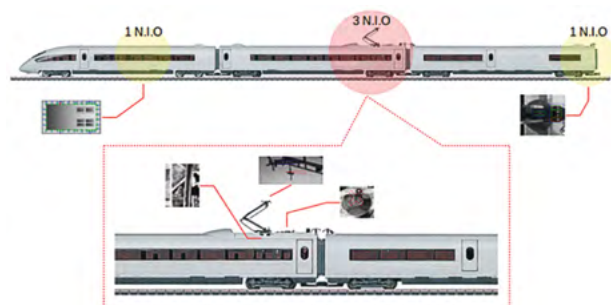
When known maintenance intervals are combined with existing analysis data, Analytics can calculate and display the failure probability for an entire train, for example, as color-coded diagrams, percentage values, trend plots, correlation tables and more. The accuracy can be increased by prioritizing or classifying particular components as operation-critical parts to prevent potential downtimes and related costs before they happen.

Failure probability based on the current maintenance interval:



Optimizing maintenance intervals based on component quality assessments

Analytics can be used to evaluate the quality or deterioration of all monitored components. This enables maintenance crews to identify and systematically replace any wear- or failure-prone parts at the right time. This contributes to streamlining maintenance intervals, reducing time and spare part costs and leads to increased train availability.





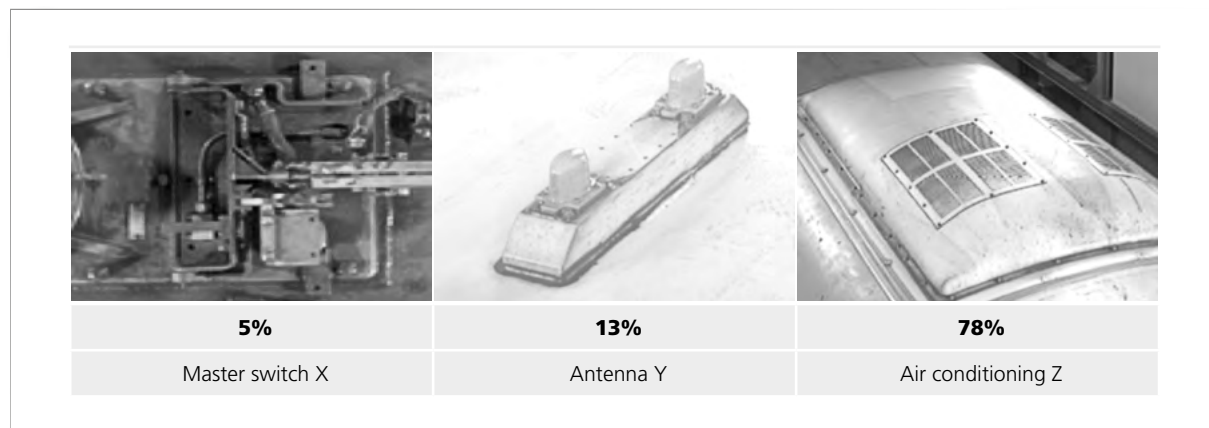
Analytics – Sample Applications

3. Assembly Inspection and Quality Assessment of New or Existing Components

Analytics enables maintenance crews to log, analyze and monitor new components and installation methods.

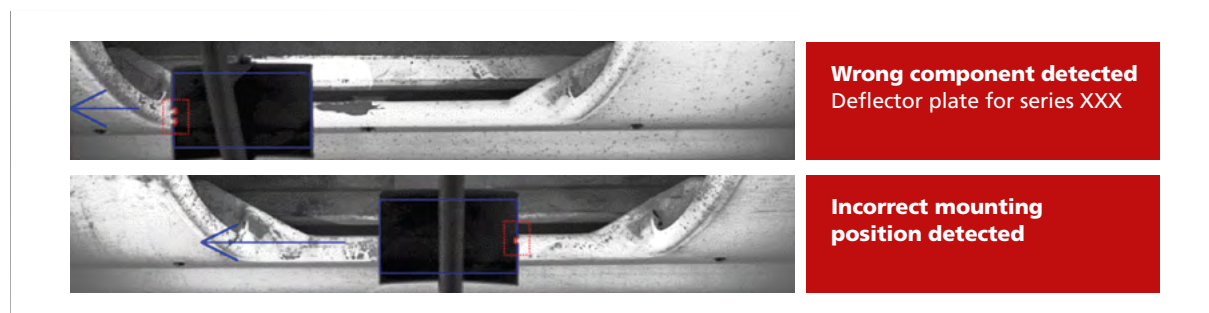
Modifications to the structure of every single train can be recorded and individual train profiles can be updated to include newly installed parts, providing a detailed overview of use of new components within the entire fleet.

Number of newly installed components, antennas and air conditioning units:



This allows for a direct comparison and quality assessments of new and existing components or installation methods. Newly added components can be checked for proper installation and any installed parts that are unsuitable for a particular train model can easily be identified and replaced.

- >> The use of standardized components across the entire fleet helps to improve inventory management
- >> It also increases component reliability
- >> The ability to assess the condition of installed components helps to improve component quality on an ongoing basis





4. Adding Performance-enhancing Parameters

In addition to the recorded data a variety of external parameters can be used to increase failure probability accuracy, including those that directly impact the components' lifespan.

Parameters such as weather conditions, traveled distance, velocity or component replacement and maintenance intervals for individual trains can be particularly useful.



5. Cloud for Optimized Data Management

Uploading train data to the cloud increases both data safety and availability. Train data and analysis results can be accessed at any time from any location.

The cloud eliminates data constraints, provides a central storage location and optimized data management huge data volumes. Data from various systems at different locations can be analyzed and used simultaneously to explicitly highlight trends or dependencies.



We keep
We keep an eye on your train.
AI on your train.



AUTOMATED TRAIN INSPECTION

Conclusion: Reliable Camera Systems Guarantee Operational and Process Stability

COMPONENT PORTFOLIO OVERVIEW

- >> The data is easily transmitted between sites for enhanced inspection capabilities, e. g. defects or creeping wear
- >> Preventive and condition-based maintenance ensures increased availability
- >> Analytics includes machine learning for continuous maintenance optimization
- >> Cost-effective inspections and consistent process reliability. The track in the maintenance shop is freed up for other tasks
- >> Expandable system can be used for any areas that require inspection on the train roof, sides or underbody and can be customized for different types of trains.

The inspection reports are created automatically and can be viewed via an intuitive user interface.

The analysis results are repeatable, reliable and immediately available. They can also be accessed via the *Automated Train Inspection mobile App "Train Inspect"*.



INSPECT. ANALYZE. OPTIMIZE.

We are convinced that your company will benefit from automated train inspection and would be happy to discuss the details of a custom solution with you. Contact us today to schedule an appointment for a personal consultation.

Subscribe to our **free newsletter** to receive information about automation news and trends.



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