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SBB Monitors Swiss Railways

With imc Data Acquisition Systems

imc Test & Measurement
Application Note

APPLICATION NOTE

Introduction

The SBB has developed stationary wheel-load checkpoints that can automatically acquire key data from a passing train in real time. With the help from imc, these checkpoints are equipped with high-precision strain gauge bridge amplifiers, as well as an industrial PC according to customer specifications. The system is designed to acquire safety-relevant load data, such as axle overloading and cargo shifting. It also recognizes flat spots on the wheels.

The measurement data is analyzed in real time and – if necessary – steps are taken to ensure safer and more secure railway travel. For example, trains can be instructed to slow down or even stop completely. In addition, condition-based maintenance can be arranged.

The Goal: Safer Railways

Rail traffic is generally very safe. But when problems do occur, there can be a lot at stake – from massive damage to loss of life.

Railway companies are therefore investing heavily in technical security measures to ensure the safe and efficient operation. The ideal railway monitoring system:

- runs 24 hours a day, 7 days a week
- works in real time
- is largely automated
- reliably detects technical problems before they turn into dangerous situations.

Through an extensive and close-knit network, stationary measurement systems attached directly to the train track measure relevant physical characteristics of passing trains travelling at normal operating speeds. The measurement data is then transmitted directly to the control room and evaluated. If there are relevant deficiencies detected, immediate action is taken – for example, trains will need to slow down or stop. This automated railway monitoring system in Switzerland has been consistently expanded, developed and networked by SBB.



FIGURE 1.
SBB Cargo train.

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Part 1: Wheel-load Checkpoints

Essential parts of this expansion are the wheel load checkpoints. Safety-critical load data are acquired and controlled as:

- the maximal permissible axle load
- the maximal permissible right/left load ratio (unbalanced load)
- deviation from the declared overall weight

The wheel-load checkpoints developed by the SBB are equipped with strain gauges attached to the left and right sides of the track and are connected to the imc CRONOSflex modular data acquisition system. It is set up with two 8-channel bridge amplifiers and a universal amplifier for acquiring temperatures.



FIGURE 2.
The imc CRONOSflex data acquisition system

The fully synchronous measurement within the device and its complex real-time signal processing qualify this imc data acquisition system to be used for an operation that monitors safety.

The measurement system acquires data to detect:

- load shifting
- axle overloading
- flat spots on the wheels

From the integrated real-time signal analysis performed in the device itself to the calculation of complex variables, the acquired primary data are thus reduced, by compressing and enriching, in terms of their complex "informational content".

Part 2: The Overall System

Because of the multiple networking and communication possibilities, the wheel load checkpoints can be easily and comfortably integrated into the existing overall railway monitoring system. In this way, the SBB currently has 20 wheel-load checkpoints set up in Switzerland.

Another benefit to the SBB is that the overall development and maintenance of the system are taken care of by only two partners. The measurement hardware, including the IT component, is completely overseen by imc and the software side by a secondary partner of the SBB. This ensures effective communication and fast response times.

System Overview

- Measurement PC from imc T & M; custom-made according to customer specifications
- imc CRONOSflex – PC independent, decentralized, distributable data acquisition system with direct online analysis of measurement data.
- Software integration via imc DEVICES and imc COM
- 20 nodal points – Each nodal point is equipped with:
 - imc CRONOSflex
 - Two 8-channel strain gauge bridge amplifiers
 - One universal measurement amplifier for temperature acquisition

Conclusion

The SBB operates 20 wheel-load checkpoints that allow for automated monitoring of all the trains on the Swiss rail network. The quality of the primary acquired measurement signals – for example with resolution, precision and bandwidth – could be improved over previously used methods using imc measurement technology: the achieved resolution, for example, is improved tenfold. As a result, a more accurate diagnosis can be provided, thus, increasing the quality of the available information.

The goal was achieved: The trains are safer, have fewer breakdowns and save time and money for the SBB and their customers. Limiting the responsibility for the entire system to just two partners resulted in effective implementation with shorter reaction times.