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Measuring Wheel-Rail-Forces Efficiently

A New Standardized Housing Solution for the imc MTP-NT Telemetry

imc Test & Measurement **Application Note** //
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APPLICATION NOTE

Introduction

TÜV SÜD Rail GmbH supports manufacturers, infrastructure operators, and railway undertakings with a comprehensive range of testing and certification services for the rail sector. The expertise of TÜV SÜD's assessors and experts is based on more than 50 years of experience in international rail projects and cooperation with railway authorities and other stakeholders worldwide in the fields of conventional railway systems, high-speed trains, and urban rail systems.

TÜV SÜD Rail is also internationally recognized as a testing and certification body, as well as a Notified Body (NoBo), Designated Body (DeBo), and independent Assessment Body (AsBo). The company employs more than 450 interdisciplinary experts, operates its own testing facilities for railway applications, and uses proprietary testing tools.

TÜV SÜD Rail's projects include validating vehicle running dynamics. In this area, TÜV SÜD Rail performs measurements of wheel-rail forces on behalf of customers or provides customer-specific instrumented wheelsets for testing by other testing bodies. For running dynamics measurements as part of vehicle validation, TÜV SÜD Rail and imc Test & Measurement have developed a new non-destructive and time-saving measurement solution based on imc MTP-NT telemetry.

André Rohrbeck,
Teamleiter Messradsatz,
TÜV SÜD Rail

"Telemetry systems used in line tests on railway vehicles depend on experience and close cooperation.
The combination of our application expertise and imc's manufacturer know-how creates a partnership that works – especially when fast support is needed."

A Modular Telemetry for Reliable On-track Testing

In the field of running dynamics testing, the use of wireless, radially radiating signal transmission offers clear advantages over an axially mounted solution. The greatest benefit is the ability to mount the measurement technology on the wheelset without having to modify it. In addition, a modular system architecture is advantageous for mounting amplifier modules close to the sensors and in an easily accessible location.

For TÜV SÜD Rail, it is important that a telemetry system provides the necessary interfaces for data transmission, can be installed on the wheelset quickly, and allows system components to be exchanged efficiently. The latter is particularly important given the high costs associated with on-track tests. If a system needs to be replaced, it should be possible to do so on the track as quickly as possible.

Thanks to its signal quality, the MTP-NT telemetry system from imc Test & Measurement provides a good solution for these requirements. What was still missing for TÜV SÜD Rail's specific needs was a standardized, railway-proof housing solution that would enable the individual components to be exchanged quickly.

Until now, the MTP-NT telemetry modules were installed in housings that had to be specially developed and manufactured for each individual project. The resulting development costs — and particularly the poor interchangeability of modules in the event of a defect — made these projects significantly more expensive.

As part of a partnership with TÜV SÜD Rail, the new MTP-NT-XS system was therefore developed on the basis of MTP-NT telemetry. Its purpose is to simplify the installation of the telemetry system, reduce setup times, and accelerate the replacement of components in service cases. At the same time, it improves the system's resistance to the harsh environmental conditions encountered in railway operation.

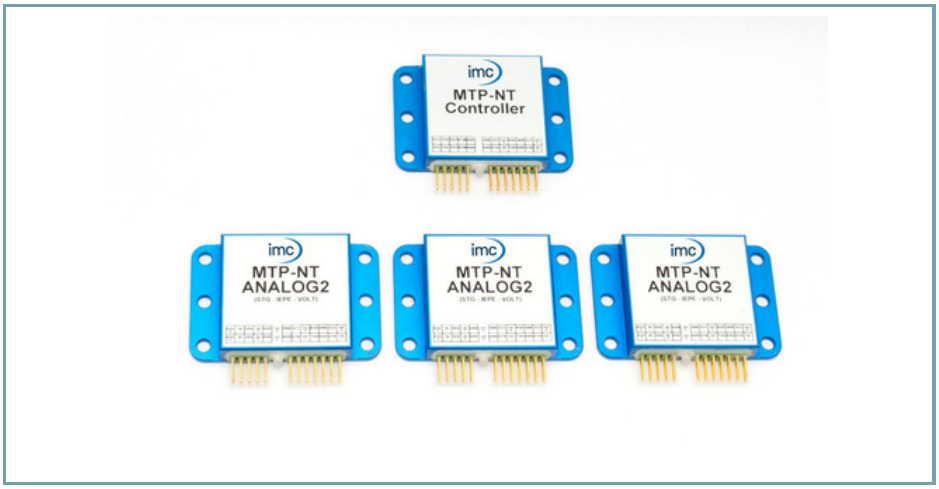

Figure 1.
imc MTP-NT Telemetry-Modules, available are two housing variants

Especially for the rental of instrumented wheelsets and for internal validation projects, MTP-NT-XS offers decisive advantages: with the new imc MTP-NT-XS devices, modules can be exchanged much faster, more flexibly, and more easily. The ability to reuse existing measurement applications without renewed configuration significantly shortens preparation times and increases the availability of the overall system.

Figure 2.
imc MTP-NT-XS housings

Measuring Wheel-Rail Forces - A Data Acquisition Challenge

TÜV SÜD Rail uses the imc MTP-NT telemetry system on wheelsets during validation and certification tests in which wheel-rail interaction is determined during line tests. The forces acting at the contact point between wheel and rail are not only responsible for derailment safety and therefore

operational safety, but also have a direct impact on the wear of both wheel and rail.

In running dynamics testing, it is verified whether the wheel-rail forces remain in an appropriate relationship to one another during operation and whether safe vehicle operation is therefore ensured.

Operationally Reliable in Harsh Environments

During on-track tests, the measurement system is exposed to a wide range of external influences, as the housings are mounted to the wheel using adapters. In addition to high rotational speeds, the telemetry system must be operationally reliable against the ingress of dust and particles from steel and plastic. It must be able to withstand winter temperatures, as well as rockfall, which occurs when chunks of ice fall from vehicles onto the track bed and kick up ballast. It must also be resistant to splashing water.

At high speeds, this splash water can act like a high-pressure cleaner and damage both housings and wiring. The design of the seals, housing, and connectors must meet these special requirements while also withstanding the impact acceleration of the railway wheel on the rail.

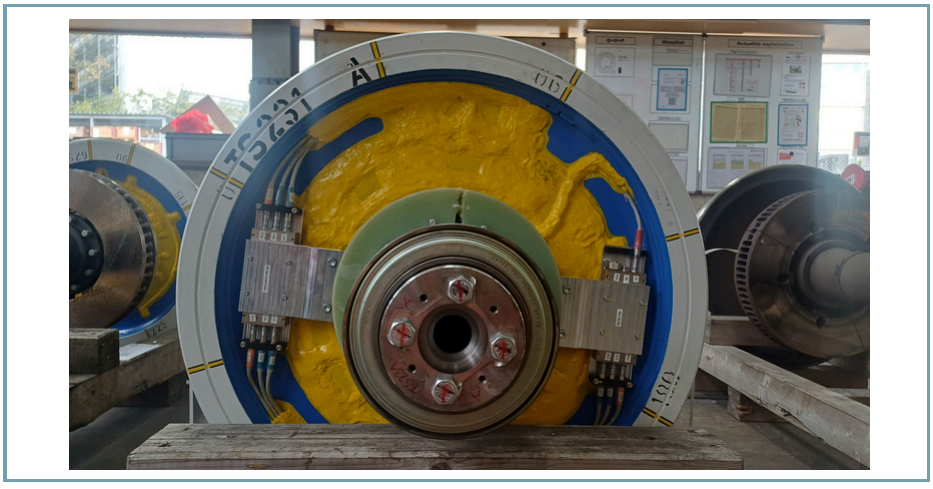

Figure 3.
Rail wheel set with *imc MTP-NT-XS system*
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imc MTP-NT Telemetry

MTP-NT measurement modules can be configured as a small, flexible telemetry system with a modular structure. The system consists of freely

selectable data acquisition modules, a controller module, and an inductive data transmitter and a power transmitter unit. Depending on the user's requirements, the telemetry system can be freely configured and subsequently adapted.

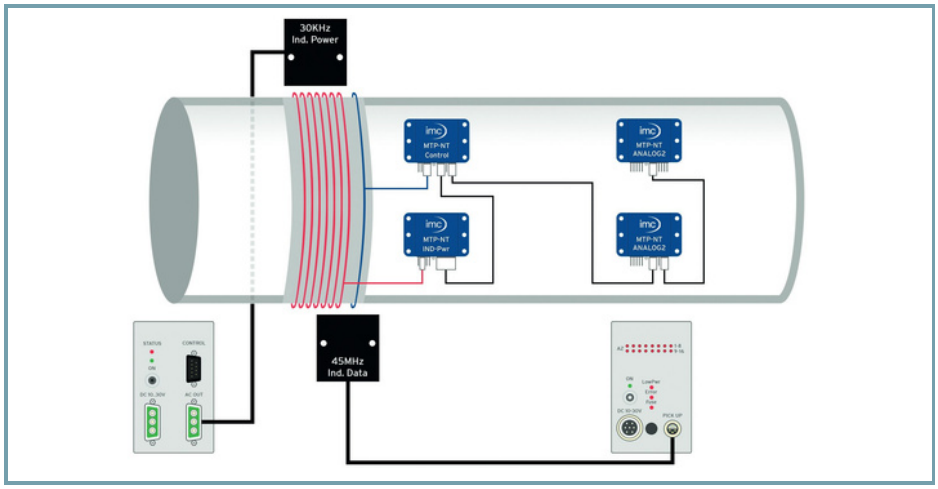

Figure 4.
Installation of imc MTP-NT Modules on a rotating component, inductive power Supply and data transmission

The newly developed imc MTP-NT-XS is based on MTP-NT technology in a robust and standardized metal housing. It is designed for use in harsh environments and is available in two variants. Low weight and high strength are the two decisive factors for use in demanding environments.

The imc MTP-NT-XS measurement system is available in two variants: the imc MTP-NT-XS-BASE contains the controller for measurement data processing and inductive data transmission, as well as a power supply module for conditioning the energy transmitted to supply the imc MTP-NT-XS devices on the rotating side. It also provides two freely configurable slots for integrated MTP-NT-XS data acquisition modules with two channels each, such as temperature, analog, STG modules, and others.

As with the Base, the MTP-NT-XS-EXT also allows for the installation of measurement modules; it offers freely configurable slots for, for example, temperature, analog, or STG modules, each with 2 channels. Both device variants feature integrated waterproof connectors. This allows an imc MTP-NT-XS-EXT to be connected to the imc MTP-NT-XS-BASE, and further imc MTP-NT-XS-EXT devices can be connected in sequence.

Inside the housing, the modules are bolted and secured. They can be easily removed, replaced, or reused for maintenance purposes. The imc MTP-NT-XS measurement device also has IP68 protection.

Technical Specifications of the imc MTP-NT Telemetry

- *Channels: 2–128*
- *Signal bandwidth: 0–24,000 Hz*
- *Input types: strain gauge, thermocouple type K, PT100, PT1000, IEPE, voltage*
- *Resolution: 18 bit*
- *Transmission: inductive or wireless*
- *Power supply: inductive or battery-based, among others*
- *Housing: robust and water-protected*
- *Operating temperature: -40 to +85 °C.*
- *Module dimensions: depending on design, approx. 60 × 40 × 10 mm or approx. 60 × 40 × 20 mm*

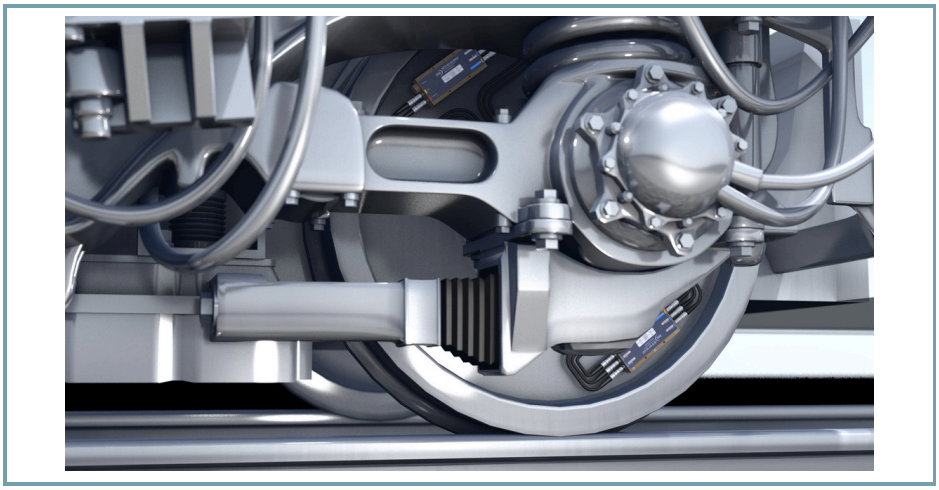

Figure 5.
imc MTP-NT-XS Installation on Rail Vehicle Wheel

A Versatile Data Acquisition System

The imc MTP-NT series offers users both modular, specifically adaptable measurement solutions and - with the MTP-NT-XS variant - a wide range of standardized measurement solutions designed for demanding operating conditions. At the same time, modern interfaces, data transmission protocols, and hardware components ensure a high level of future-proofing and access to current technological standards.

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