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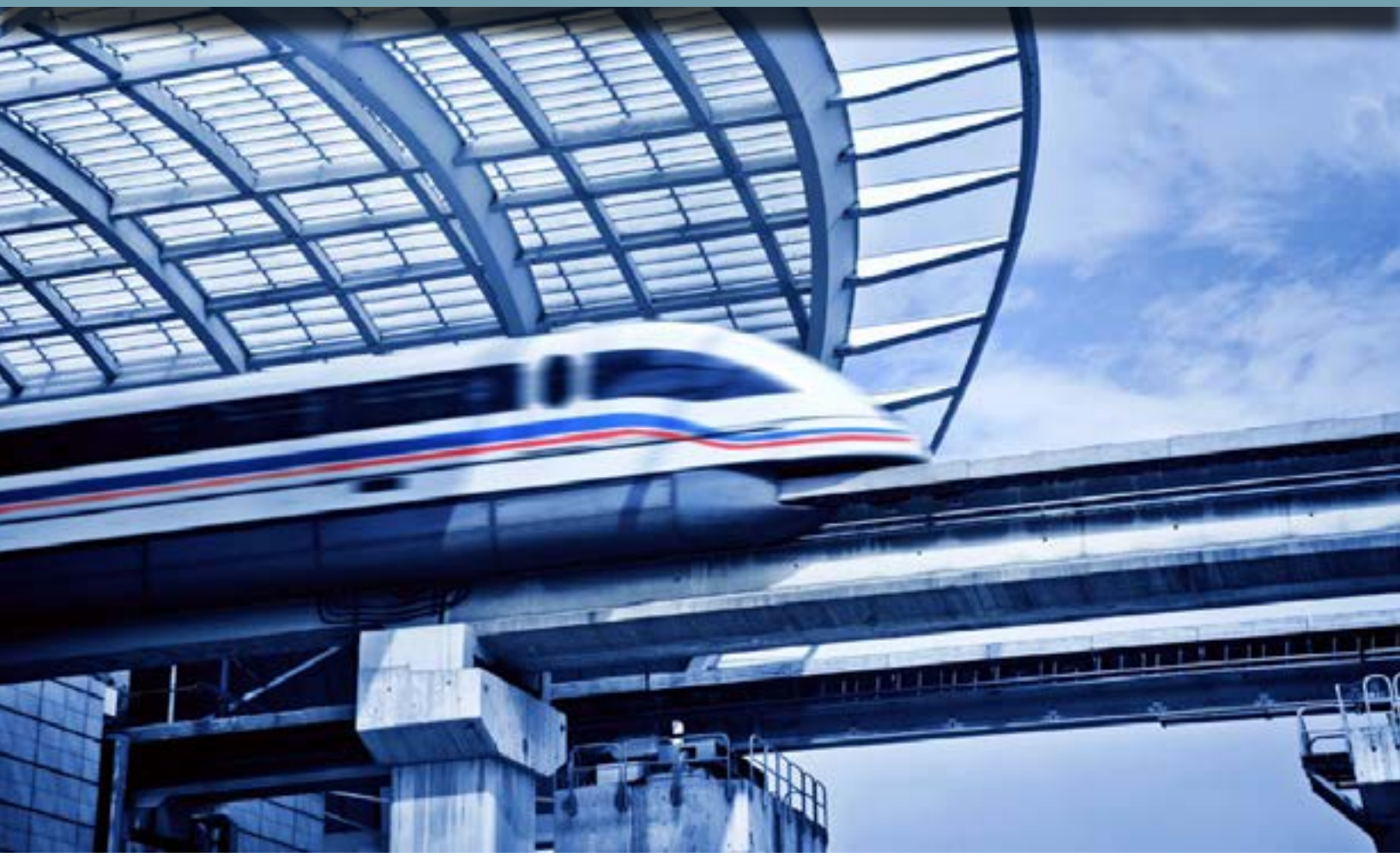

From Prototype to Serial Production Maturity

imc Measurement Technology for Rail Vehicle Testing

imc Test & Measurement

Feature Note

FEATURE NOTE

Getting development on track using specialized railway measurement technology

Finding efficient solutions for the specific requirements of railway technologies is of decisive importance for the manufacturers of railway vehicles. Safety issues play as much of a role as passenger comfort, speed and economic factors.

Extensive testing and measurement are performed prior to technical approval and commissioning of the new vehicles. Based on more than 15 years of experience in the testing of high-speed trains, as well as with standard applications in rail vehicle manufacturing, the company imc has created solu- tions to meet these requirements.

Test and measurement solution by imc provide ...

- the direct reading of rail vehicle-specific bus systems.
- the system enables measurement results to be recorded and analyzed quickly and reliably.
- decentralized, distributed measurement: effective, flexible and safe.
- maintain an overview at all times with real-time measurement systems.
- the use of robust measurement technology for rail-specific loads.

Your benefit - our goal:

- Save time: Real-time calculations already in the measuring device
- PC-independent, robust, mobile and secure
- All measuring devices can be networked and synchronized
- All imc systems can be controlled with one software
- Application-specific extensions
- Everything from a single source - throughout the entire measurement cycle

Direct import of railway-specialized bus systems

The recording of fieldbus information, such as that delivered by the Multifunction Vehicle Bus (MVB), IPT-COM or IWT, provides new data capture possibilities. The MVB-Bus serves the purpose of transmitting information and commands within complex rail vehicle systems. Such components as the power train, brakes and air conditioning can be precisely inspected, analyzed and optimized in regard to their entire complexity.

The imc CRONOS*flex* is an integrated and modular device concept, which extracts measured variables directly from the MVB and handles them in combination with analog measurement channel data such as mechanical strain, acceleration, and temperatures. The data transmitted via MVB are imported in synchronization with all other measured data and subsequently treated as internal to the system.

FIGURE 1.
imc CRONOSflex DAQ system

Rapid and reliable measurement results with imc CRONOS*flex* and imc STUDIO

Whether it's analog measurement on a few channels, or complete technical approval testing for a high-speed train on over 1,500 channels - in every case, the issues of measurement effectiveness and quality of results are crucical. In these issues, the software- and hardware components of the measurement systems play an important role. With this in view, the measurement engineering software imc STUDIO offers clear and user-friendly handling.

Even large channel counts are displayed in an organized manner, so that all data are available to multiple operators for viewing and analysis purposes Additionally, it is possible for data channels from a variety of sources to

be displayed in imc STUDIO according to their respective measurement assignments.

imc STUDIO's curve window is a tool which enables user-defined display of data accumulating during measurement. Direct and immediate verification of the measurement is possible by means of measurement cursors and markers in the curve window. Placing comments with signal events can be accomplished in either textual or audio form.

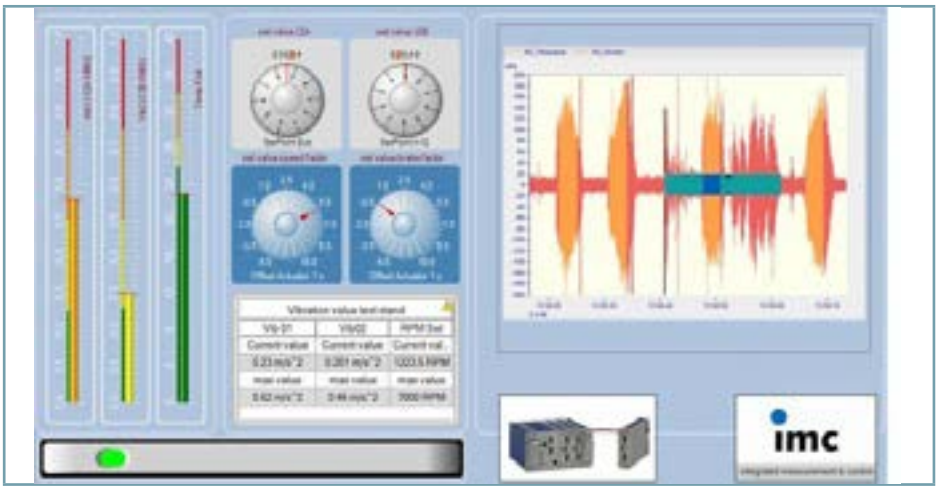

FIGURE 2.
imc STUDIO Panel with individually configured GUI

The imc STUDIO Panel: Configuring tailored user interfaces quickly and easily

The design of the imc STUDIO's imc Panel component combines extensive functionality with an adaptable user interface – without requiring the hassle of complex programming.

A wide variety of elements such as the curve window, numerical values, thermometers, pointer gauges, bar meters, text boxes, tables, switches, dials, buttons and much more are easy to place by means of the Drag & Drop technique and to associate them with functions. In this way, the user can design customized operating and display interfaces within a very brief time, which can also be used in the hard-copy report.

Saving time using imc STUDIO

imc STUDIO makes it easily possible to automate recurring measurement routines. The integrated imc Sequencer serves to join up individual measurement and analysis steps into a single sequence. Such routines as "Load Configuration", "Start Measurement", "Analyze Data", and "Compose Report" are simple to define, and so are even complex, multi-page user interfaces.

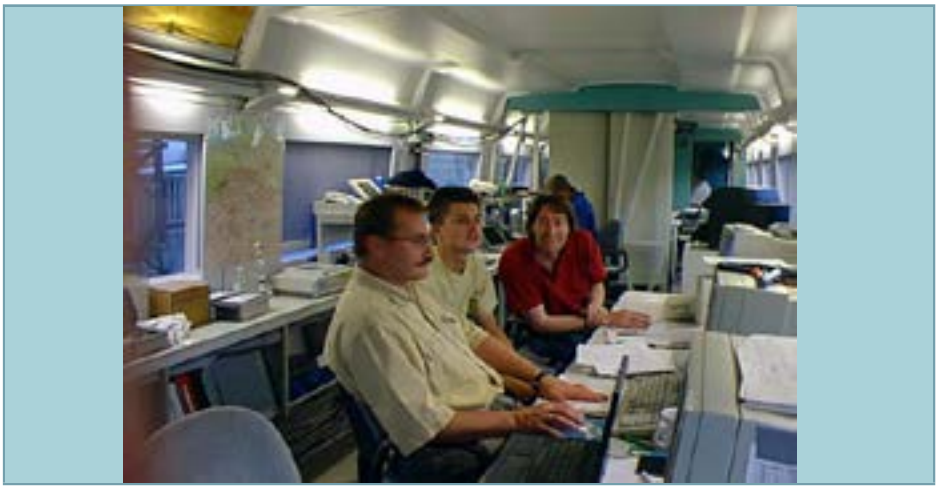

FIGURE 3.
On-site test and measurement in a train

Performing decentralized measurements: effective, flexible and reliable

Just as measurement locations can be distributed throughout the various cars on a train, it needs to be possible to have a decentralized measurement system consisting of distributed local amplifiers and data recording and storage components.

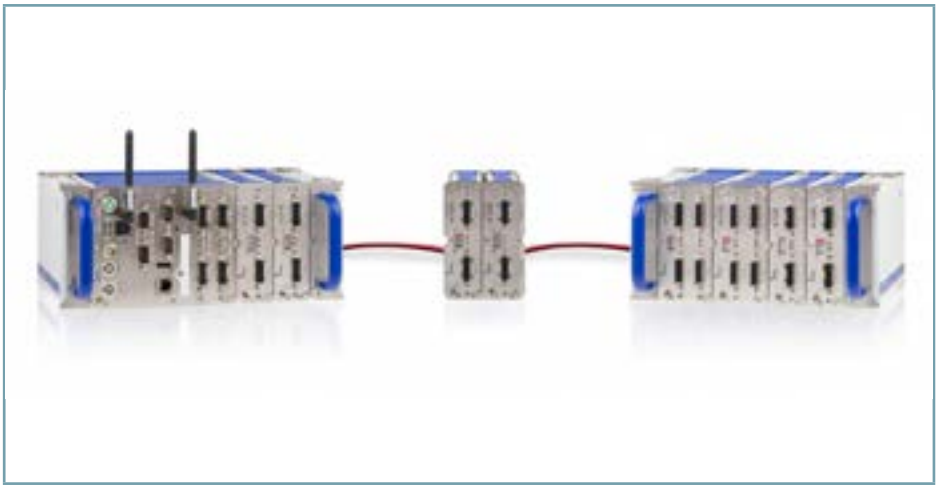

FIGURE 4.
imc CRONOSflex in a distributed setup

These assemblies are arranged in a flexible way and directly at the sensor location, according to requirements. This makes installation and setup extensive, problem-prone and expensive sensor cabling obsolete. It also reliably avoids electroma- gnetic interference.

The imc CRONOSflex measurement system, with its network-based modular system architecture is the ideal platform for this purpose.

Keeping track of the big picture through real-time measurement capability

The decentralized, distributed capture of measurement data both within and outside of the train is performed by imc systems in complete synchronization. Additionally, real-time processing, linkage and analysis of the data are thus possible.

FIGURE 5.

Analog channels and the data from the train's internal fieldbusses can be processed online already during the measurement. By linking various data streams from different locations around the train and subjecting them jointly to calculation operations, it is possible to capture and categorize variables characterizing the operation status of whole functional assemblies. This substantially surpasses the information content which can be obtained from "simple" direct measurements. And in consequence, analysis does not have to wait for a separate subsequent process step. Instead, analysis can proceed in synchronization with, and be available alongside the raw data for visual display plus archiving and management.

This means that during a running test drive, a comprehensive overview of the train's current status, as well as of its individual components is available at any time. And beyond this, the immediate availability of real-time analysis results allows timely intervention in the unfolding test process, if necessary During test runs, it is possible to monitor and classify an enormous volume of data and complex results quickly, reliably and effectively even as testing proceeds.

imc provides support for this capability through "live multi monitoring". All data can be accessed from multiple monitoring stations (or PCs) in parallel, for the purposes of visually displaying the data and to tag them with accompanying commentary in either textual or audio (voice) form.

This meta data information, assigned along with associated cross-references to the respective measurement channels, is saved, together with any complementary video channels, in order to achieve an integrated overall profile consisting of analog, digital, virtual (calculated), fieldbus- and multi- media-channels. The entire "pool" of measurement information is available for sophisticated storage management, databases, and subsequent analysis procedures by means of imc FAMOS as well as of external tools. In this way, well-founded results are placed at the disposal of the appropriate R&D or inspection personnel who handle, for example, the braking, chassis, or power train systems.

Rugged measurement equipment tailored to railway related stresses

imc measurement devices for railway applications are designed for mounting directly on the bogie. Thanks to their extraordinarily robust construction, even continual mechanical shock loading, as well as exposure to dust and projectile gravel, are no problem for these units. The imc measurement equipment is proven in harsh environmental conditions and performs its work reliably throughout an extremely wide climatic range.

Beyond this, the measurement devices provide decisive flexibility: any device already configured can be quickly transplanted – ensuring swift transition between field and lab settings.

FIGURE 6.
imc CRONOScompact-02-BR2-4-IP65

FIGURE 7.
imc CRONOScompact-02-BR2-4-IP65 with protective caps

TEDS-capability - automated sensor profile import

Another important aspect of imc amplifier channels is their compatibility with TEDS, enabling automatic import of all sensor profile information, such as the sensor type, sensor location, sensor power supply, transfer factor, input range and sampling rate, etc. In this way, it is possible to hook up the sensors without needing to manually assign channels to the measurement device accordingly. Instead, individual assignments to the all-purpose measurement channels, as well as parameterization, documentation and data management are accomplished by the software.

Even strain gauge bridges for S/N curves can be equipped with TEDS and supplied with the necessary information directly at their respective installation location. This is of crucial importance for the purpose of reliably achieving very complex measurement setups, in which there may be hundreds of sensors installed.

From single components all the way to total infrastructure solutions

Large, spread-out system configurations are especially easily achieved by means of imc measurement equipment. For the role of system components, the individual devices are equipped with standard Ethernet terminals, universal wide-range DC power supply (10 … 50V DC), and precise synchronization mechanisms.

FIGURE 8.
Infrastructure component Measurement Control Unit (MCU)

Turnkey-ready solutions

Even for the purpose of managing the overall system, imc provides turnkey solutions meeting the particular requirements of the rail vehicle manufacturing industry. These include fiber-optic based, interference-free network solutions, UPS buffered PC technology and data servers, centralized internal reference clocks and modular power supply units.

The infrastructure boxes are suspended in a vibration-damping housing frames which are modular and easy to transport and install, making them ideal for mobile applications and operation in harsh environments.

FIGURE 9.
Infrastructure components: Measurement Control Unit (MCU) und Time Control Unit (TCU)

Compact, practical, organized: imc Switchbox

The distribution board unit imc SPoE Switch IP65 enables the networking of multiple devices within a car with the modules working remotely under extreme conditions, attached to the bogie. By means of imc Switchbox, measurement devices can be hooked up with a power supply, synchronization and LAN-communication lines all with a single network cable. Having fewer cables not only means easier installation and more clarity, but also more flexibility, since devices are easier to relocate in consequence.

FIGURE 10.
imc Switchbox