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Source: Daimler Truck AG

Big Test Data in vehicle development

Management of vehicle measurement data in development and operations – with software from Kistler

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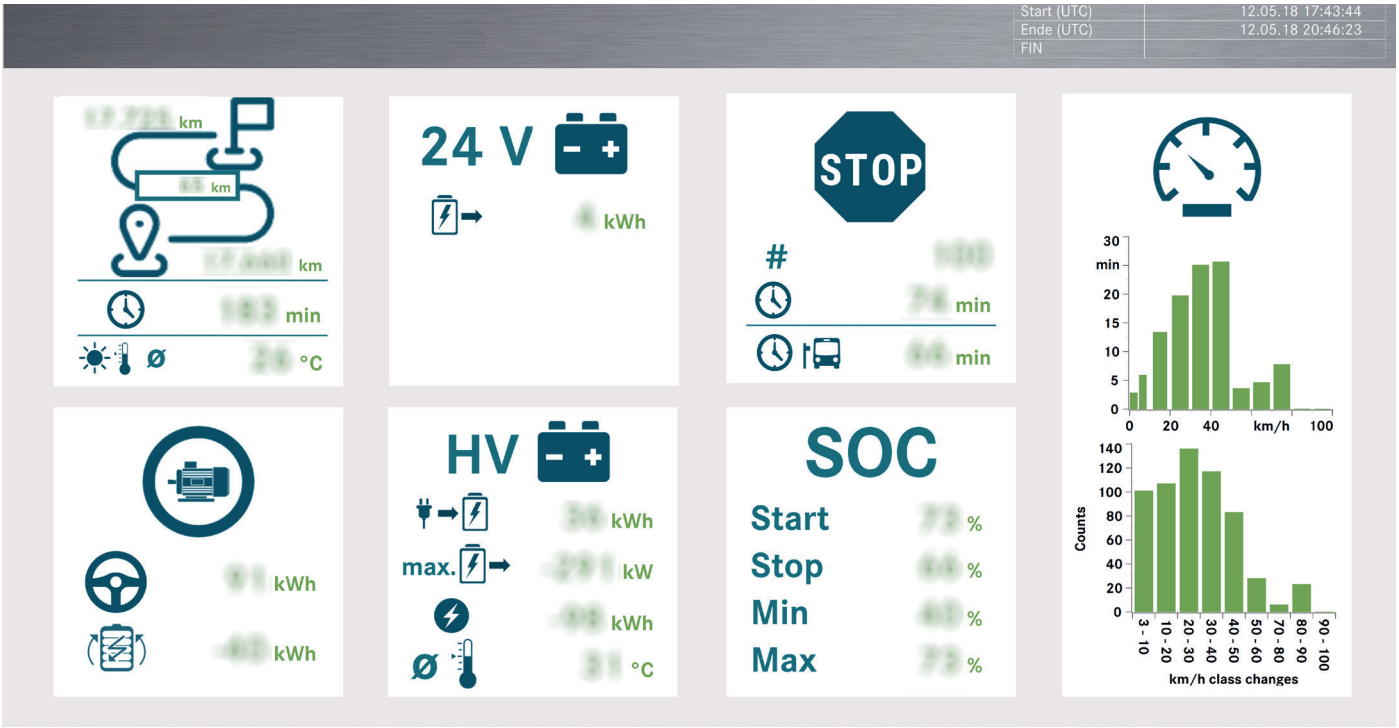


What is known as a 'minimal dataset' from on-road operation of a hybrid bus, transmitted regularly to the Federal Ministry of Transport and Digital Infrastructure with the help of MaDaM from Kistler.

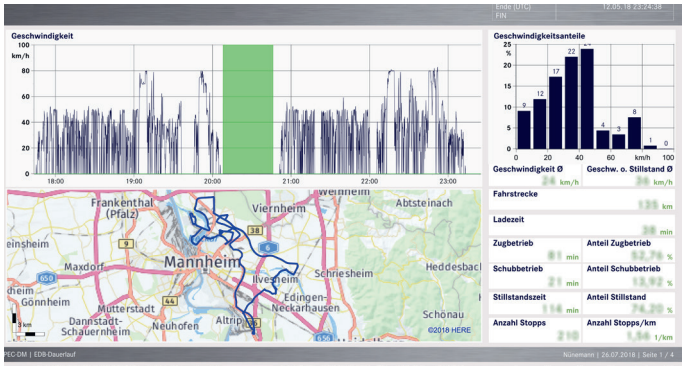
For bus manufacturers all over the world, integrated management of measurement data plays a critical part in development work: they use data loggers to record every detail about their vehicles. The MaDaM software from Kistler continuously stores and organizes the data, which can then be visualized and comprehensively evaluated with additional solutions from the Kistler portfolio such as jBEAM.

The ongoing transformation in the automotive industry is impacting vehicles of every type, including buses and commercial trucks. These changes are not limited to electrification of the power train and alternative propulsion concepts: increasing use of software as an instrument to generate value is an equally important trend. Daimler Buses relies on holistic measurement data management from Kistler for its vehicle trials and development work, and the company also uses this technology for information exchange with customers such as municipal transport providers and travel companies.

As the European market leader, Daimler develops and manufactures state-of-the-art buses at multiple European sites and also in Turkey. Daimler Buses launched a fully electric variant of its popular Citaro city bus (the eCitaro) back in 2018; the hybrid version had already been on the market for some time. Software solutions such as MaDaM, jBEAM and jBEAM Cluster from Kistler play a key part in ongoing development and fleet management for these and many other models. As long ago as 2016, the Daimler subsidiary introduced MaDaM from Kistler for its bus business in response to the constant increase in data volumes, enabling it to make optimal use of the data. MaDaM is a 100 percent plug-and-play solution that can be used not only in vehicle trials and development work, but also for after-sales activities in collaboration with end customers.

Vehicle developers benefit from Big Test Data

Because MaDaM is so flexible, it allows users to record many different types of measurement data and store it in vast quantities. Categories include vehicle dynamics parameters such as velocity and rotational speed, parameters for subsystems such as doors, and diagnostic data for individual components. Efficient indexing and organization make it fast and easy to locate and evaluate the data – in the form of load spectra, for example. Johannes Wübbeling, a software engineer at Kistler's Chemnitz facility, explains: "When we were developing the architecture for MaDaM, we deliberately decided against the ASAM ODS standard for managing measurement data: even though it's commonly used, it imposes strict requirements for data formats, search fields, and so on. With our software, customers are free to define their own data model. MaDaM's sustained success in a highly complex and wide-ranging project like this one shows that we were right to opt for greater flexibility."



Everything at a glance – all the time: an overview of the measurement data recorded from city buses operating in Mannheim (Germany) using MaDaM from Kistler.

To date, Daimler Buses has recorded more than three million measurements with MaDaM – and around 2,000 new ones are added every day. Many users from different departments feed in data from over fifty sources, in six different file formats. Measurements usually begin as soon as the engine is started; in buses, they are handled by data loggers installed as standard, but these loggers can also be retrofitted on vehicles if required. For typical applications such as endurance tests that run for at least a year with changing weather conditions, MaDaM automatically generates and transmits reports at regular intervals.

However, the advantages of holistic measurement data management are not limited to vehicle testing: this approach also delivers outstanding benefits when new drive types need to be assessed. For example, it becomes easy to compare fuel consumption between hybrid and conventional buses in regular service. Electric buses support features such as smart onboard power supply: daily usage can be documented in various levels of detail, and the data can be supplied to the operators as well as the Federal Ministry of Transport and Digital Infrastructure.

Efficient data evaluation – even including data mining

Alongside flexibility and high performance, critical advantages for customers include the visualization and evaluation options offered by jBEAM. Also, both MaDaM and jBEAM are highly versatile systems that feature extensive functional scope. Users can quickly locate measurement data for use in automated reporting. These benefits open up almost unlimited possibilities for development and vehicle testing. Recording measurement data also yields advantages in operation: during regular bus services, for example, specific performance parameters (such as battery consumption on electric vehicles) can be accurately monitored and any potential irregularities or faults can be analyzed rapidly and effectively.

> "This project taught us a lot about the application-based approach to developing our solutions. In that regard, dialog with customers and joint development work on the software were especially valuable aspects."
>
> Johannes Wübbeling, Software Engineer at Kistler's Chemnitz facility

Kistler maintained regular dialog with the customer in the course of a close working relationship, and this played a key part in the ongoing development and specification of the solution. Wübbeling emphasizes the value of a collaborative working style: "This project taught us a lot about the application-based approach to developing our solutions. In that regard, dialog with customers and joint development work on the software were especially valuable aspects." Endurance tests, in particular, generate enormous volumes of measurement data that can be analyzed with the help of data mining algorithms to detect recurring patterns. MaDaM and jBEAM have the processing capacity and performance scope needed to handle applications such as these: on the hardware side, the Kistler solutions are now based on as many as five servers.

For passenger cars and buses alike, it is not yet possible to foresee what the drive technologies of the future will look like because development is proceeding at such a dynamic pace. Fuel cells could well play a major role – especially in the coach segment, where range is a highly critical factor. As multiple types of drive technology become available, complexity will inevitably increase: ever greater volumes of data will be generated during development and operation, so the management of measurement data is bound to become an even more crucial factor in the future.

Big Test Data – no problem with software solutions from Kistler

With the measurement data management system MaDaM, vast amount of measurement data can be efficiently managed and flexibly evaluated.

The post-processing software jBEAM, which is integrated in MaDAM, can visualize and analyze measurement data from many different applications and data formats, for example in the field of vehicle testing.

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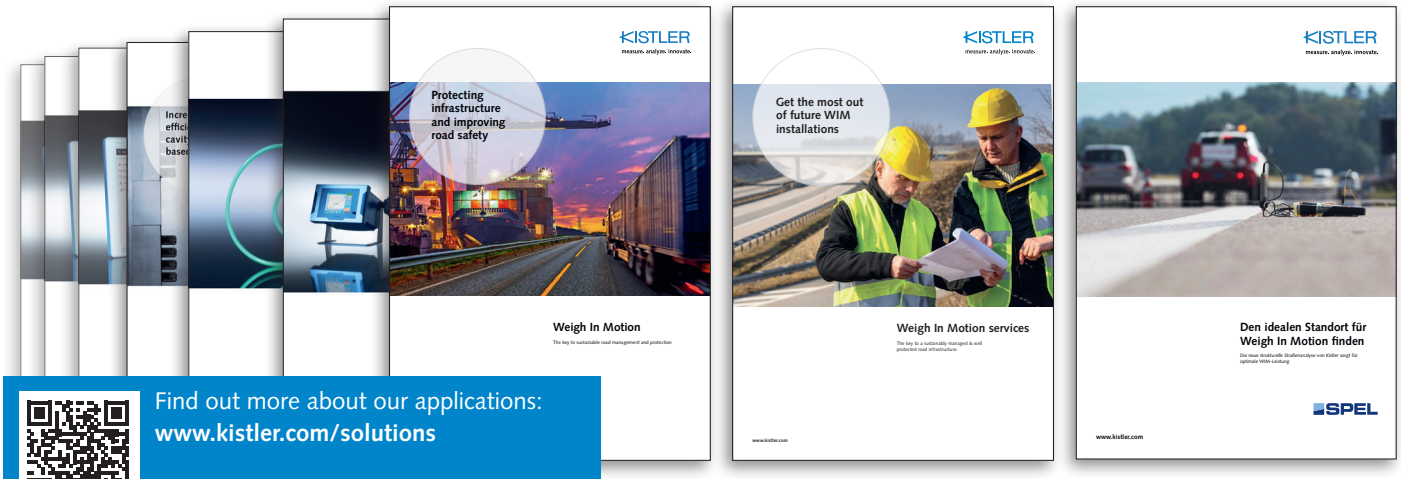

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Kistler Group
Eulachstrasse 22
8408 Winterthur
Schweiz

Tel. +41 52 224 11 11

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