UniCAN 3 Data Logger

Flexible data recording wanted: Fuel cell trucks under endurance test

Data recording

The development of hydrogen-powered trucks, whose electric motors are driven by electricity from fuel cells, initially required numerous tests on test benches. Various driving tests were then carried out in pre-series fleet tests. A data logger from CSM was installed to reliably record the results during both test situations: The UniCAN 3 was particularly impressive due to its configurability via remote access.

Green powertrains for trucks

In addition to purely battery-electric vehicles, alternative concepts are also becoming relevant in the commercial vehicle sector. One approach: powering trucks with fuel cells, i.e. generating electrical energy from the chemical reaction with hydrogen directly in the vehicle. The battery installed in the drivetrain is significantly smaller and lighter, as it does not serve as the primary energy source, but only as an intermediate storage unit. Robert Bosch GmbH, the world's largest automotive supplier, manufactures mobile fuel cell systems for this purpose, so-called “Fuel Cell Power Modules”, which are being tested by various vehicle manufacturers worldwide.

Fig. 1: Bosch Fuel Cell Power Module TwinBox: The scalable fuel cell system for generating electricity using hydrogen in the vehicle is used primarily in the commercial vehicle sector. (Picture: Bosch, bosch-mediaspace.de, ID: 105252AA)

Data recording for long-term analysis

During extensive testing at both the bench and in fleets, measurement data from the control units of the mobile fuel cells and other measured variables were recorded in various situations. The aim was to record large amounts of data over a long period of time, and the resulting findings were able to help detect faults at an early stage. This will also accelerate vehicle development in this area in the future.

»With the growing number of pre-series systems in use worldwide, manual recording with PC-based measurement technology is no longer possible. Automatic, continuous recording means that existing data can be accessed quickly and easily in the event of a fault or other issues.«

Christian Bald, Development engineer
at Robert Bosch GmbH

Big Data in vehicle development

In order to obtain well-founded insights for improving vehicle development, the collection, storage and analysis of large volumes of data ("Big Data") is becoming increasingly important. Vehicle manufacturers and suppliers hope to obtain fundamental and more reliable information from the statistical analysis of Big Data. However, a number of challenges must first be overcome: These include reliable and complete data recording and the ability to store the large volumes of data over an extended period of time. Since the volume of data is simply too large to be analyzed manually, statistical algorithms are used. These are designed to detect patterns in the data, while questions and analyses can then be derived from the patterns.

Various test scenarios for optimum results

On the one hand, the mobile fuel cell systems were equipped with temperature sensors and measurement modules on nine endurance test benches, i. e. outside the vehicles, and the measured data was recorded with the data logger. In addition, further fuel cell power modules were equipped with the same measurement setup, some of them with additional sensors for measuring humidity, and data loggers. These were sent to the respective vehicle manufacturers to be tested in pre-series fleet tests in vehicles.

Fig. 2: The Bosch fuel cell system in the truck is fitted under the cab as standard. (Picture: Bosch, www.bosch-presse.de, ID #1e2e4630)

In the test vehicle

To ensure that the data obtained was comparable, the measurement technology used had to be suitable for both the test bench and for use in the test vehicles. Furthermore, during these iterative pre-series fleet tests, errors that were discovered during the first test runs were corrected immediately. However, this meant that the measurement and data recording requirements also changed repeatedly, as new test situations were checked again after the adjustment. The data logger configuration therefore had to be reconfigurable remotely worldwide based on the interim results of the measurements. This ensured that the changes could be made without the intervention of the test driver or removal of the data logger.

Space problems in the truck

The hardware conditions also played an important role: the data logger used had to be suitable for use in the test bench as well as for the road test. This requires a compact design and distributed use, as the device must be installed wherever space is available in the fuel cell power module. Even in a truck, there is only limited installation space for the fuel cell system. It was therefore important that the required hardware also had small dimensions. Thanks to its compact dimensions of approximately 109 × 45 × 158 millimeters, this was achieved despite the difficult conditions.

From test bench to road

To record the measurement data in the 30 test vehicles of the pre-series fleet – with up to 3,000 signals – the fuel cell systems with the UniCAN 3 data loggers were installed in the individual test trucks.

»With its up to 12 CAN interfaces, the data logger from CSM offers a suitable overall package and meets our requirements for the most comprehensive data acquisition possible for such a complex system. In addition, the device has sufficient performance to reliably record and send the large volumes of data and can still be integrated without any problems thanks to its small dimensions.«

Alexander Bludau, Development engineer
at Robert Bosch GmbH

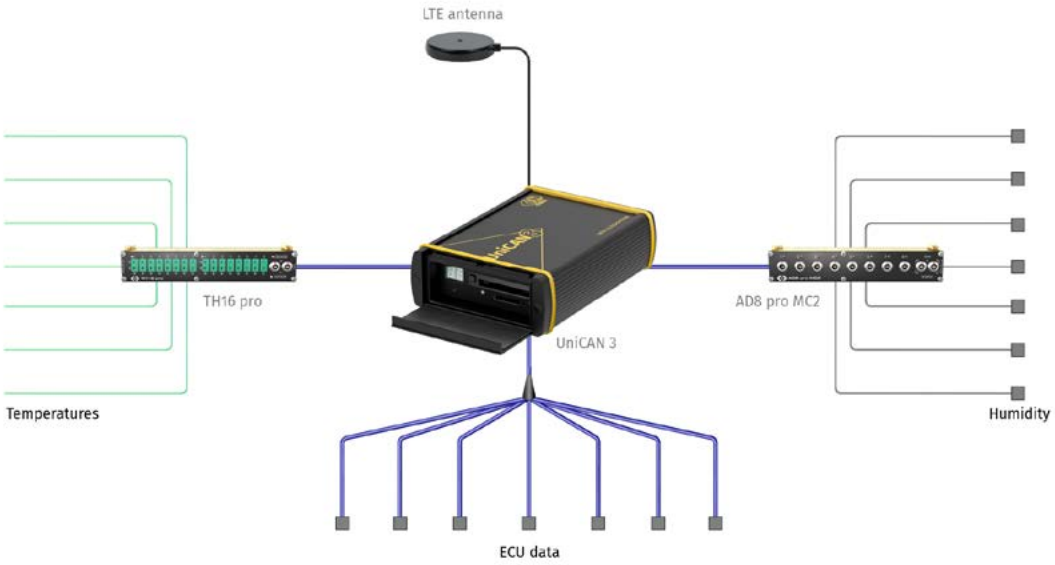

Fig. 3: Schematic measurement setup in the test vehicle.

Many measurement channels & integrated modem

The UniCAN 3 recorded data from nine CAN sources: seven of these were CAN bus data from the control units of the fuel cell power modules. In addition, also via CAN, temperatures from the area around the mobile fuel cells were measured with thermocouples and THMM 16 pro Type K temperature measurement modules. Humidity was also measured in the air paths of the fuel cells using special sensors and AD pro mini modules via CAN.

Thanks to the integrated modem, configurations of the UniCAN 3 could also be adjusted at any time during the fleet test via remote access, while the data was simultaneously transmitted in.

An LTE antenna placed on the vehicle roof was used to receive mobile communications while the data logger was installed in the fuel cell system at axle height of the test vehicles.

»As one of the main requirements was to use a data logger that could be configured remotely at any time and was as compact as possible, the all-in-one solution of the UniCAN 3 with integrated modem convinced us immediately.«

Christian Bald, Development engineer at
Robert Bosch GmbH

User-friendly software interface

The associated CSMuniconf configuration software also made it easy to configure the data logger without any additional programming knowledge. Important status information and signal values could be read out directly on the test bench using the integrated live monitoring function when connected via the USB interface. This made it possible, for example, to verify whether the devices were connected correctly, or the signal strength was sufficient before starting the test or sending the fuel cell power modules.

Software architecture for "big data" measurement tasks

In the road test, the data was transmitted via LTE and processed by the integrated conversion software (CSMdataconv). CSMdataconv automatically converted the collected data into the appropriate format before transferring it to the cloud for long-term archiving and analysis. The stable operating system of the UniCAN 3 data logger ensured reliable data recording, while the associated software functions, including fleet management, considerably simplified the implementation of this “big data” project.

»As we have already had very good experiences with the data loggers and associated software solutions from CSM in the past, the UniCAN 3 devices were once again our first choice. They represent a flexible overall system that is ideally suited to our requirements. In addition, the technically competent support with short response times is also of decisive importance to us for the reliable running of our project.«

Paul Meyer, Development engineer
at Robert Bosch GmbH

The UniCAN 3 – an all-rounder

A flexible data logger is required if the same measurement technology is to be used to record data both on the test bench and in test vehicles. The compact dimensions ensure that the UniCAN 3 can be easily integrated into both test environments, while data transmission and configuration adjustments can be carried out remotely via the integrated modem. This avoids the need to remove the data logger and thus saves time and money, especially in the case of measurement tasks that require constant adjustments.

Featured Products

UniCAN 3

The data logger UniCAN 3 was developed especially for the use in the automotive sector: Up to 12 CAN interfaces, freely configurable inputs and outputs, Wake-on-CAN, LAN and WLAN, support of CAN FD. In addition, data transmission via LTE modem or WLAN allows worldwide use.

AD pro CAN MM-Serie

The AD pro CAN MiniModules (MM) allow a wide range of applications for the measurement of signals from sensors with analog voltage outputs (voltage, current, pressure, flow rate, etc.). A status LED for each channel makes it easy to verify proper operation. An extended scaling with 32 axis points per channel facilitates sensor linearization.

THMM 16 pro

THMM 16 pro enables precise distributed temperature measurements with K, J or T type thermocouples. Thanks to its low temperature drift, it delivers very accurate measurement results over the entire operating temperature range.

Complete solutions from a single source:

CSM provides you with comprehensive complete packages consisting of measurement modules, sensors, connecting cables and software - customized to your individual needs.

Further information on our products are available on our website at www.csm.de
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