Helping out on the race track

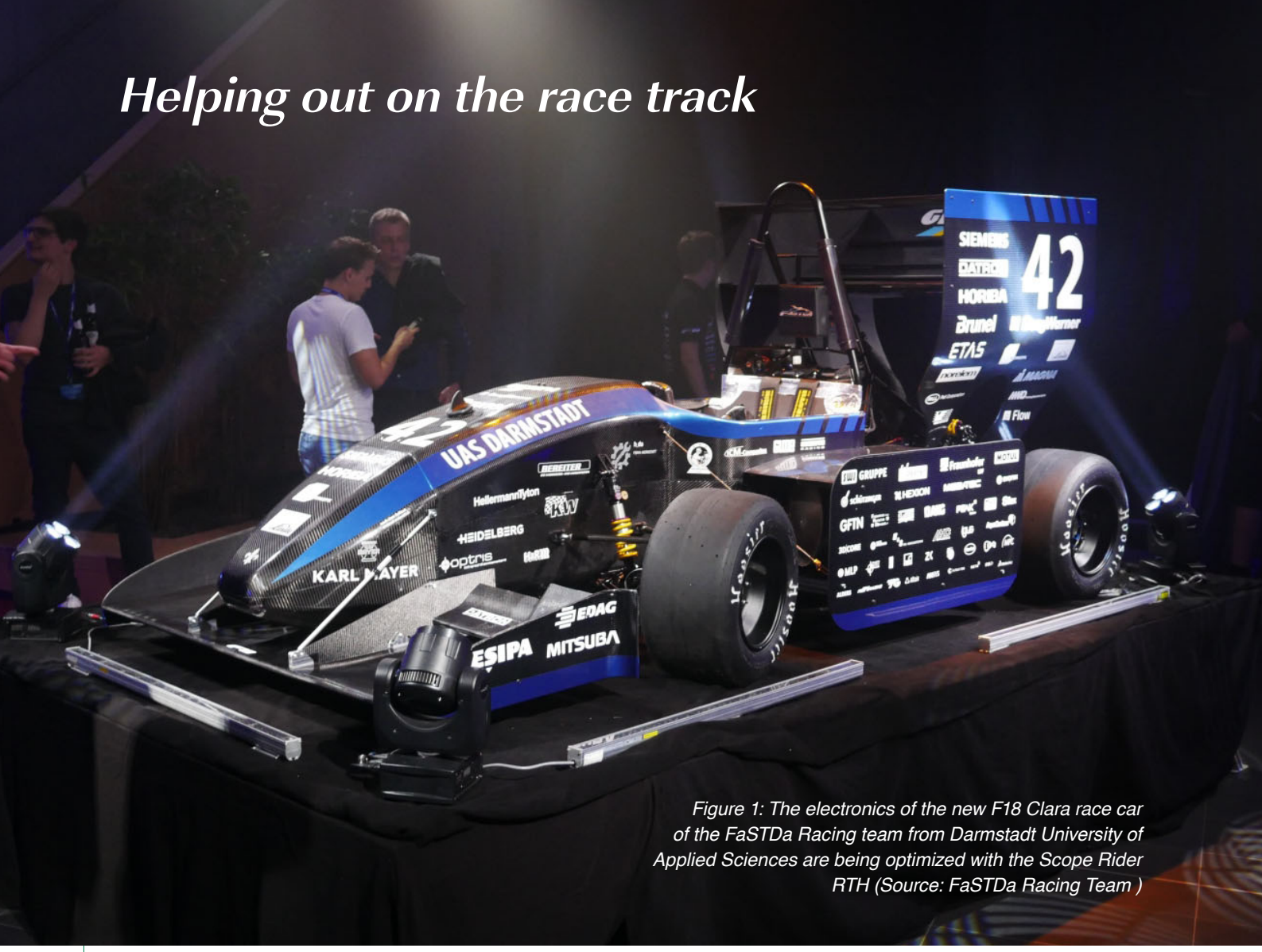

Figure 1: The electronics of the new F18 Clara race car of the FaSTDa Racing team from Darmstadt University of Applied Sciences are being optimized with the Scope Rider RTH (Source: FaSTDa Racing Team)

Before a race car can hit the track, the electronics must be thoroughly tested. A CAN-capable oscilloscope from Rohde & Schwarz supports a racing team on this purpose.

The Formula Student (FS) competition features student-developed race cars resembling Formula 1 cars. The FaSTDa Racing team from Darmstadt University of Applied Sciences equipped the F18 Clara – last year's race car – with extensive sensor technology. This is an area in which the students do a lot of testing with a portable Rohde & Schwarz (R&S) oscilloscope.

The integrated data-logger of the R&S Scope Rider RTH enables sensor data acquisition and long-term monitoring. Transferred CAN data can be analyzed with the decoding function. In addition, the students can reliably measure currents and voltages up to 1000 V with the handheld oscilloscope.

Formula Student

The FaSTDa Racing team is a group of students at Darmstadt University of Applied Sciences who have developed and produced their tenth race car with a combustion engine as part of a project in the 2017/18 academic year. It will compete in the Formula Student motorsport class. What matters in these races is not only the fastest car, but also the best team score. The engineering design, racing performance, cost report, and business plan are assessed at Formula Student Germany, the world's largest competition of its kind. The target customers are hobby race drivers. The jury consists of experts from the automotive and supplier industries.

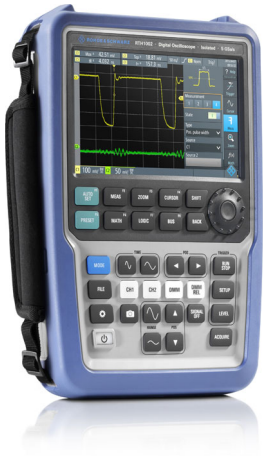

Figure 2: The Scope Rider RTH offers a wealth of functions for automotive applications (Source: Rohde & Schwarz)

Since 2006, FS Germany has taken place annually in August at the Hockenheimring ▷

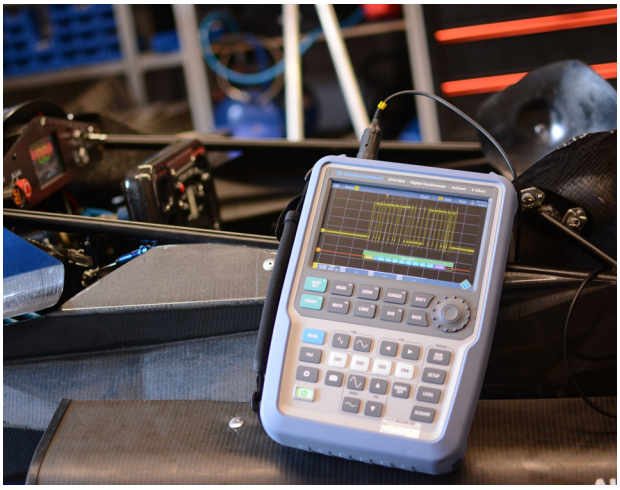

Figure 3: Debugging CAN data (Source: FaSTDa Racing Team)

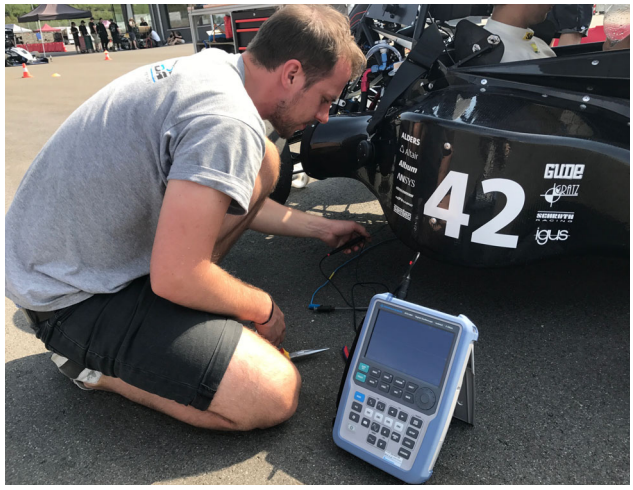

Figure 4: Niklas Waldstein measuring the engine control unit of the F17 to test ignition interruption (Source: FaSTDa Racing Team)

circuit and is sponsored by the VDI. There, the teams participate in three classes: driverless, electric, and combustion engine. Comparable competitions also take place at other internationally known race tracks. The Darmstadt team's F18 Clara was publicly unveiled in late May 2018. With a 59 hp modified one-cylinder KTM engine, it accelerates from 0 km/h to 100 km/h in 4 s and has a top speed of around 130 km/h.

The budding engineers optimized their race cars up until the first races in late summer 2018. Racing performance includes attributes such as vehicle dynamics, handling, acceleration, endurance, and fuel or energy consumption in autocross, skid pad, acceleration, and endurance races.

Measuring the engine control unit

They needed an instrument to measure the engine control unit. The FaSTDa Racing team received the Efficiency Award in 2017 at the Formula Student East competition in Hungary and wanted to build on this success with the F18. In order to further optimize efficiency, the F18

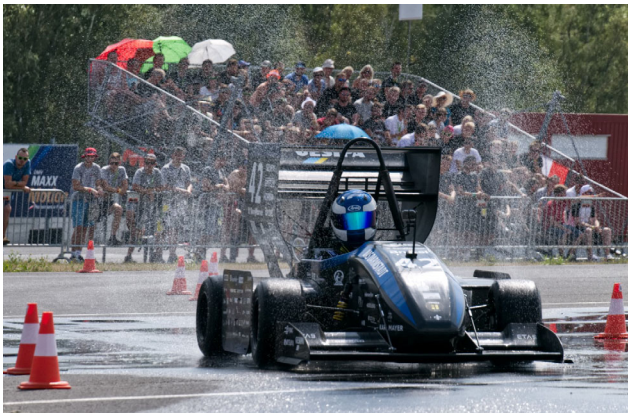

Figure 5: F18 Clara on the wet surface of the Most circuit in the Czech Republic (Source: FaSTDa Racing Team)

features a very light chassis and a new engine control unit.

The students developed their own PCB (printed circuit board) and the necessary software. During a race, all important parameters can be seen at a glance on the display in the cockpit, including engine speed, oil temperature, oil pressure, battery voltage, and speed. The F18 uses numerous sensors connected to measurement modules. These modules send the data to the cockpit via a CAN interface.

For troubleshooting and optimization of the control unit, the team were looking for an instrument with an integrated data-logger for acquisition and long-term monitoring of the sensor data. It also had to be able to analyze CAN data. Furthermore, the oscilloscope for troubleshooting on the car needed to be sturdy, portable, and certified for high voltage measurements. The solution: the R&S Scope Rider RTH.

The young engineers opted for the portable R&S Scope Rider RTH. With its isolated inputs, it enables engine voltage measurements up to 1000 V (RMS) in measurement category III. What's more, Rohde & Schwarz has equipped the oscilloscope with special analysis functions for automotive applications.

Strengths

The triggering and decoding options of the R&S Scope Rider RTH support not only the conventional CAN and LIN protocols, but also protocol analysis functions for Sent – a serial point-to-point protocol defined specifically for sensor communications in the automotive sector. Users can thus acquire specific events, data or error states of the fast and slow Sent protocol channels. It also supports the short and enhanced message formats and the various available CRC check methods.

With the R&S RTH-K9 CAD FD serial triggering and decoding option based on the R&S RTH-K3 CAN/LIN serial triggering and decoding option, the user can analyze CAN FD signals. At transmission rates of up to 15 Mbit/s, the CAN FD serial bus is significantly faster than Classical CAN (up to 1 Mbit/s) and is gaining in importance.

The fully digital trigger and decoding unit operates at a sampling rate of 1,25 Gsample/s, irrespective of the analog or digital channel sampling rates used for signal ▷

CAN Newsletter Online: Car racing

CAN data-logger
Used to develop a student racing car
Tongji Dian Racing from Tongji University performed well in last year's Formula Student China ranking 4th. Kvaser's CAN/CAN FD data-logger was part of it.
Read on

CAN Newsletter magazine
Electricity in the blood
A small device with a big impact: The IVT current measuring technique from Isabellenhuette can even be found in racing cars today.
Read on

Measurement system
Used in Formular E racing
Isabellenhuette's IVT-F shunt-based measurement system is used in race cars of the FIA Formular E. For the communication between the system and battery control unit, a CAN interface is used.
Read on

Automotive Testing Expo 2016
Race car instrument
The Speedbox-INS by Race Technology (UK) continuously monitors its own performance and reports the maximum error for each braking test.
Read on

Mobile Tech Award
App shows motor sport data in real time
The Mobile Tech Awards were awarded for the fourth time on March 24 at the Mobile Tech Conference and the Internet of Things Conference in Munich. GPSoverIP received the Award in the category Connected Service for their Racing App.
Read on

Racing car
Winning with CAN
At this year's Electronica (November 11 to 14), students of Munich Motorsports presented their racing car for the Formula Student race. A connected oscilloscope showed the car's CAN communication.
Read on

World Solar Challenge
Students built solar racing car
To improve the robustness of Blue Sky Solar Racing's new electrical car system, Phoenix Contact (Germany) has sponsored the University of Toronto on their 2013 solar car.
Read on

acquisition. This makes it possible to easily decode serial protocols even when very slow time domain signals are displayed at the same time.

At the press of a button, the R&S Scope Rider RTH displays the currently analyzed protocol in table format together with additional protocol-specific information. Another benefit is support for symbolic labels. Decoded control signals are displayed in plain text, making it very easy to work with the instrument. Example measurements The R&S Scope Rider RTH was also used to debug the CAN data of the F17 last year. This ensured that all values were displayed correctly in the cockpit.

In addition, the portable oscilloscope is used to test and optimize ignition interruption in the engine control unit. For this task, it was especially important to Maximilian Kuhnert that the oscilloscope is portable. As well as being part of the electronics team, he is responsible for sensor technology and data-logging for the FaSTDa Racing team.

The optimization measures paid off with the F17. At the start of the 2017 season, the FaSTDa Racing team took first place in the efficiency category at Formula Student East, held at the Örkény Euroring in Hungary.

At the first race of the 2018 season in late July in Most (Czech Republic), F18 Clara came 12th out of 32 teams despite unfavorable circumstances. The race was stopped prematurely due to a thunderstorm. In early August 2018, the team achieved a very respectable 16th place with the F18 Clara at the Hockenheimring circuit in a field of 58 teams with combustion engines. In the last race of the season at the end of August 2018 on the slippery pavement of the Circuit de Barcelona-Catalunya, the F18 managed to achieve 10th place overall. The car once again showed that it performs reliably even under adverse conditions. ◀

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