CURRENT THINKING

Chris Pickering offers a snapshot of the developments currently fuelling an electronics revolution

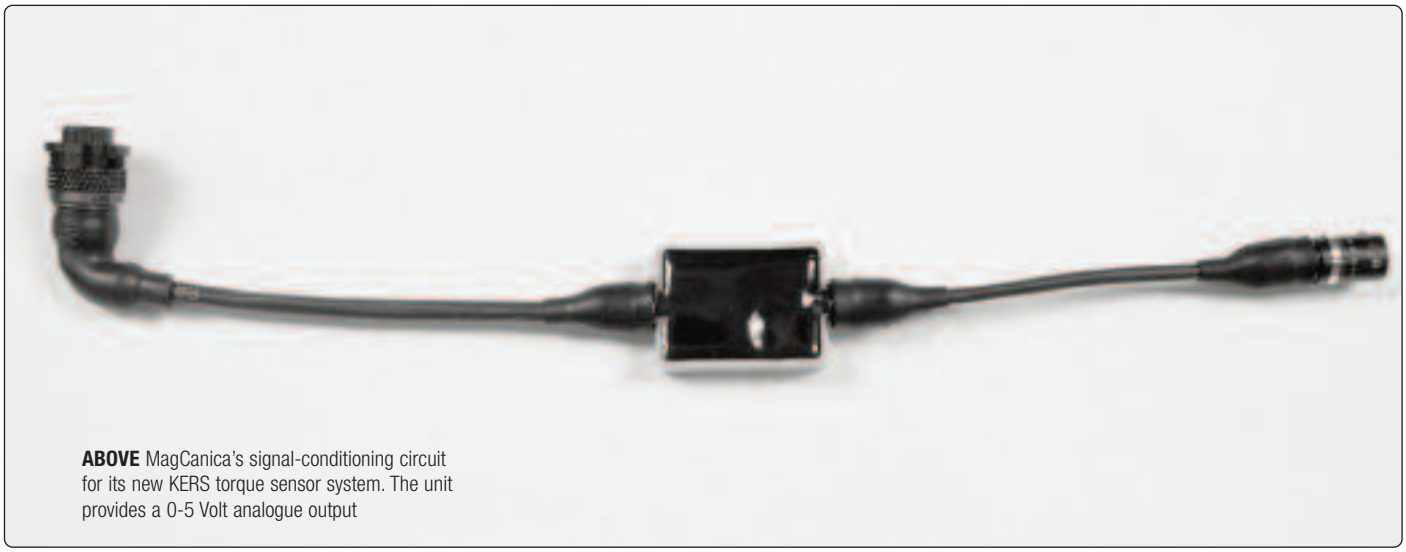
THERE IS one thing that connects virtually every competition car ever made. Something that spark ignition engines have, by definition, relied on since the start, and without which the emerging alternative technologies wouldn't be feasible. From producing a simple spark (itself a fine science) to controlling dozens of complex active systems on a top-end modern race car, motorsport simply wouldn't function without electronics. Here we examine some of the latest products in this broad, yet rapidly expanding, market.

CAN SYSTEMS LTD

The modern race car is awash with electronic control systems governing everything from the powertrain operation to the cockpit temperature. In order to communicate with all these devices, a system known as the controller area network (or CAN) is fast replacing the traditional wiring loom, and Cheltenham-based CAN Systems Ltd (CSL) specialises in providing just such a product.

It is essentially a serial bus running around the car, which uses a standardised ISO-defined communication protocol. Each module can send and receive signals

ABOVE CAN Systems Ltd specialises in providing the CAN-bus technology that is currently transforming the management of electronic systems in race cars



ABOVE MagCanica's signal-conditioning circuit for its new KERS torque sensor system. The unit provides a 0-5 Volt analogue output

MAGCANICA

MagCanica, based in San Diego, California, is a developer of torque and rate-of-change-of-torque sensor systems for motorsport and rotorcraft applications that has been actively developing its technology and hardware. Complementing its ongoing programmes with the US military and leading aerospace industry partners such as Rolls-Royce and Sikorsky, MagCanica has recently updated and enhanced its Formula One product line.

MagCanica spearheaded the development of the first-ever raceable F1 driveshaft torque sensor system beginning in 2001. Subsequently, beginning in 2003, MagCanica expanded its efforts in powertrain torque measurement by developing its clutch shaft torque sensor system. Both systems now feature integrated signal conditioning electronics and can be found running with multiple F1 outfits. These teams are thus able to fully monitor the loads generated by their engine and transmission. The MagCanica torque sensor system effectively acts as an in-vehicle dynamometer and is especially useful for monitoring torque during difficult-to-predict transient conditions.

More recently, the company made a strategic decision in mid-2007 to aggressively develop torque sensor systems for the emerging KERS devices. "It seemed like the natural evolution for MagCanica, following our previous successes on driveshaft and clutch shaft applications," comments the company's president Sami Bitar. "Our goal is to continue to be the technology leader and the leading supplier of torque sensor systems to the Formula One market."

The KERS application posed some particular challenges due to the extremely high rotational speeds involved, the previously unknown load profiles, and the proximity of very high strength magnetic fields emanating from the MGU (motor-generator unit) which could potentially interfere with the measurement.

"Over the past 18 months we have worked intensely with F1 teams as well as KERS MGU manufacturers in order to fully understand the application from every point of view and gain as much direct experience as rapidly as possible," remarks Bitar. The company developed several prototype systems in order to explore various packaging installations (some integral to the MGU itself, and others within the associated gearing that typically connects the KERS MGU with the internal combustion engine).

Due to the close proximity of the MGU, MagCanica had to develop customized magnetic shielding solutions as well as novel magnetization methods for the KERS application in order to keep the sensor immune to local magnetic interference. The company also experimented with a variety of packaging installations and shaft materials in order to achieve the right compromise between the shaft rigidity required by the F1 teams for reliable coupling between the MGU and the engine, and the properties required to obtain a robust measurement. By the time this issue goes to press MagCanica expects to have made the race debut of its new KERS torque sensor system in Melbourne.

PERFORMANCE TRENDS

"Our Road Race/Circle Track DataMite now has GPS, for precise track mapping, and lap and segment timing," says Performance Trends' Kevin Gertgen. This, according to the company, means one sensor can replace several more labour intensive devices, making installation very easy. "You simply plug into the cigarette lighter, connect to the tachometer and place a magnetic GPS sensor on the roof and start recording valuable data."

One of the main advantages is speed. According to Performance Trends, the old method of transferring data via cables could actually take longer than the race you recorded. The new USB data logger can upload the results via an SD memory card, which speeds up data transfer dramatically.

"Of course, we have customers who want lots of data, like shock and steering sensors," says Gertgen. "They need these readings for use on seven-post shaker rigs. These rigs simulate track conditions to better understand handling adjustments. They try to simulate the same shock motions on the rig that were recorded on the track."

This data also links in with the company's 3D Suspension Analyzer – a kinematics package that allows engineers to analyse damper and steering sensor readings to see exactly what the suspension is doing out on the track.

"We are producing more demonstration movie files," adds Gertgen. "These will walk customers through the operation of some of our programs and products to make learning the system easier and faster." ▶