In summary, the benefits of vehicle fleet testing conducted by FEV can be summarized as follows:

- Worldwide development centers
- Extensive experience in the field of powertrain application
- Endurance testing and application expertise in one team
- Direct access to workshop and engineering services
- Worldwide cooperation with laboratories to measure emissions and analyze fuel and lubricants
- Substantiated knowledge of the nationwide significant regions, e.g. climatic conditions, drive cycles and fuel quality etc.

In addition to developing electronic and mechatronic systems, FEV expanded its experience in the integration of drive electronics to become an important focal point for services in the electrical/electronic (E/E) sector. This experience ranges from demonstration vehicles to turnkey production vehicles with any kind of variants. Frequently working on multi-national vehicle integration projects, our E/E engineers work in close cooperation with engine experts and users of the application in interdisciplinary teams. This is typically done directly on location at the customer site.

To integrate a drivetrain, the engine controls must be adapted to the complex electronic environment of the new vehicle. The work of the E/E engineers starts with the specification of the control unit, the required sensors and actuators, and the wiring harness. FEV experts define the requirements for each individual component in so-called “cost packs”. These are the basis for inquiries from external suppliers. This process is followed by a verification of all components that are offered with respect to packaging, functionality, performance, service life, and costs. Our engineers take charge of the entire supplier management process throughout all of the development stages of components from prototype to production. In addition to specifying the wiring assembly, creating sample wiring harnesses for the initial startup of the drives at the test bench as well as for the setup of prototypes is also part of FEV’s expertise.

Integrating the electronic drive control into the complex controller network of the vehicle requires the communication matrix to be adapted. The electronics engineers at FEV make the appropriate changes to the specification and completely revise the data bus communication (e.g. CAN, FlexRay or LIN). This is normally completed on the Hardware-in-the-Loop test bench (HiL) or directly in the vehicle. In the bench process, FEV-internal HiL-systems can be used in...
combination with a vehicle-specific rest bus simulation. To ensure proper communication, all messages on the bus and any associated labels in the control unit are checked and validated. Additional tasks of the E/E engineers include coordinating the control unit interfaces as well as checking gateway functionalities between a vehicle’s multiple data buses.

Diagnostic functions monitor the sensors and actuators, which detect inputs that have a short circuit or are open, and verify the plausibility of the input signals. As part of the vehicle integration, these diagnostics must be adapted and checked with regard to plausible signal ranges of the sensors that are being used. Faults are simulated to accomplish this and the corresponding fault entries are checked.

Additionally, the E/E engineers have to ensure communication between the control units and the diagnostic testers is complete, which are used in the service area to query fault entries. This type of communication must be adapted and tested, both for service diagnostics and for legislative OBD diagnostics.

Great importance is placed on the safety concept, which ensures that the integrated drive electronics will only generate as much torque as is requested by the driver and that the vehicle will not inadvertently accelerate in the event of a fault. The safety concept has 3 levels; whereby, the top level is in line with the torque structure of the control unit. The second level is another simplified version of the first level and can thus detect faults made during torque calculations.

Whenever there is a change to the torque structure, the second level must be corrected accordingly. FEV has developed a tool for this purpose, which permits the automatic transfer of data set changes to the second level of the safety concept. Moreover, FEV has developed its own vehicle reaction tests to check on and validate the safety concept.