New Tools for Vehicle Electronics

High data transfer rates allow universal use

With the market launch of the new FETK high-speed ECU interface and the ES89x ECU and Bus Interface Modules, ETAS is introducing a new solution for validating and calibrating electronic systems, as well as for prototyping new electronic control unit functions. Thanks to data transmission rates that are 20 times faster, the new tools meet the needs of increasingly sophisticated testing in vehicles and on test benches.

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A great many factors are making calibrating and validating electronically controlled systems in vehicles increasingly complex. In addition to emissions and safety standards, the key drivers are electromobility, advances in driver assistance systems and automated driving, and the growing number of vehicle models available worldwide.
To ensure that increasingly powerful electronics and extensive software in vehicles function properly, developers and calibration engineers need efficient tools for calibrating and acquiring large amounts of ECU data. ETAS has developed two new products that represent a great advance in efficiency – the FETK high-speed ECU interface device and the ES89x ECU and Bus Interface Modules (Figure 2).

ECU interface for high data rates with low latency
In contrast to serial interfaces such as CAN, the new FETK interface requires virtually no ECU computing power for external communication. It acquires data from the ECU via a dedicated microcontroller interface and transmits it to an ES89x module, which then reroutes the data to a PC or laptop together with data from other sources.
Maximum speed is provided by Gigabit-Ethernet and it is possible to achieve rates of up to 120 MB/s – the maximum data transfer rate for the Ethernet connection. ECU data acquisition rates of 17 MB/s are already being achieved via a single FETK. In the future, it is expected that data rates acquired by an ES89x interface module to which two FETKs can be connected in parallel will exceed 50 MB/s via the new ES89x + FETK system.

The ECU interface data is processed live in real time from a PC or laptop using ETAS INCA – the ETAS environment for measurement, ECU calibration, and diagnostics. This setup also allows users to change parameters in the ECU or have them automatically modified by INCA.

The FETK interface is compact and electrically and thermally designed for use in the vehicle. Since the interface has its own power supply, tests can be performed regardless of ECU operation. The ECU interface hardware acquires data even from control functions with cycle times shorter than 10 µs with chronological precision. Furthermore, the FETK interface can be used to efficiently program ECU flash memories as securely as with a debugger.

In addition to performing measurement and calibration functions, the FETK solution is also ideal for handling fast, time-critical control interventions (also known as function bypass). Low latencies are critical here since developers tend to rely on the bypass method – following a model-based approach. It is common to develop new control functions with ETAS ASCET or MATLAB®/Simulink® and then execute the functions on prototyping hardware.
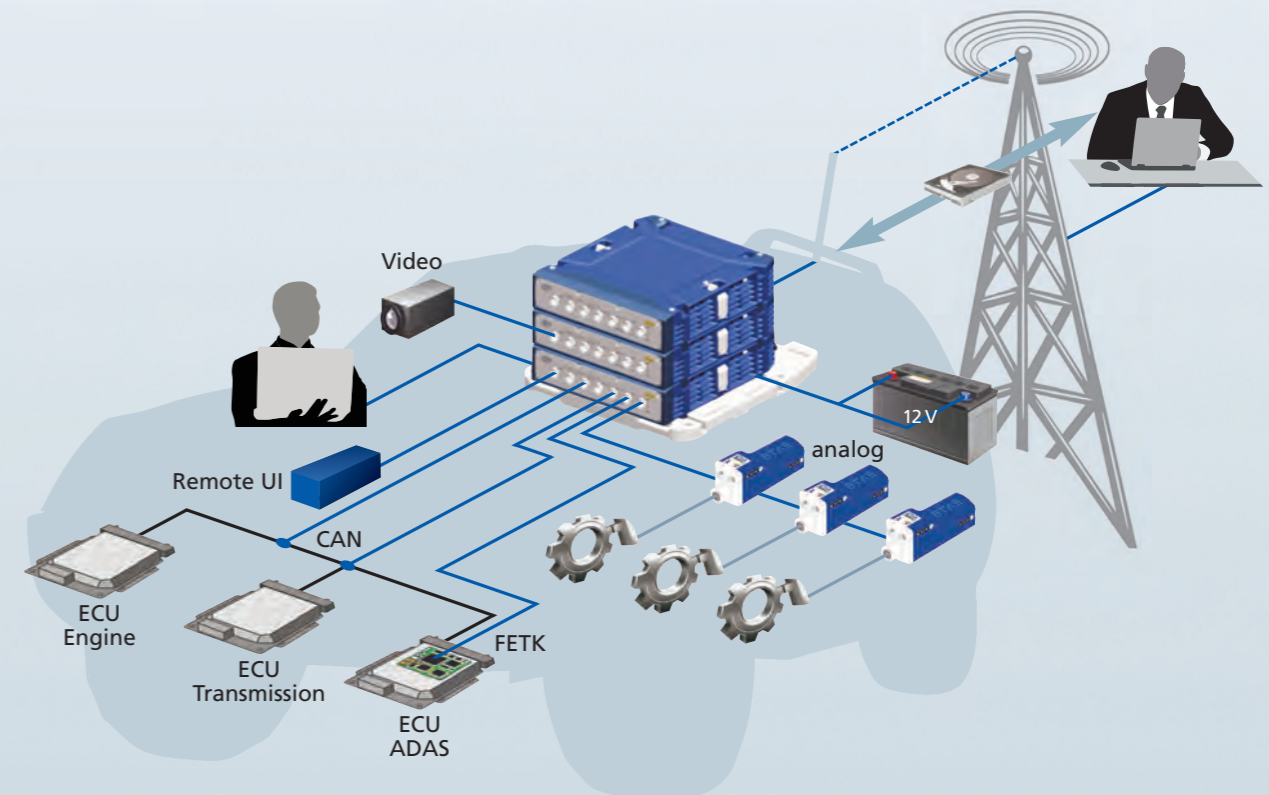

Figure 1: A test vehicle equipped with the ETAS measurement, calibration, and prototyping system of the future. The ES800 system communicates with the ECUs via FETK or serial ECU interfaces and acquires measurement data from the vehicle buses and other digital or analog signal sources in the vehicle. In the example shown, the entire measurement is recorded by a data logger. The experts in development get the data for evaluation at the end of the driving test via mobile communications.

Figure 2: The new ETAS FETK high-speed ECU interface and the ES891 ECU and Bus Interface Module.
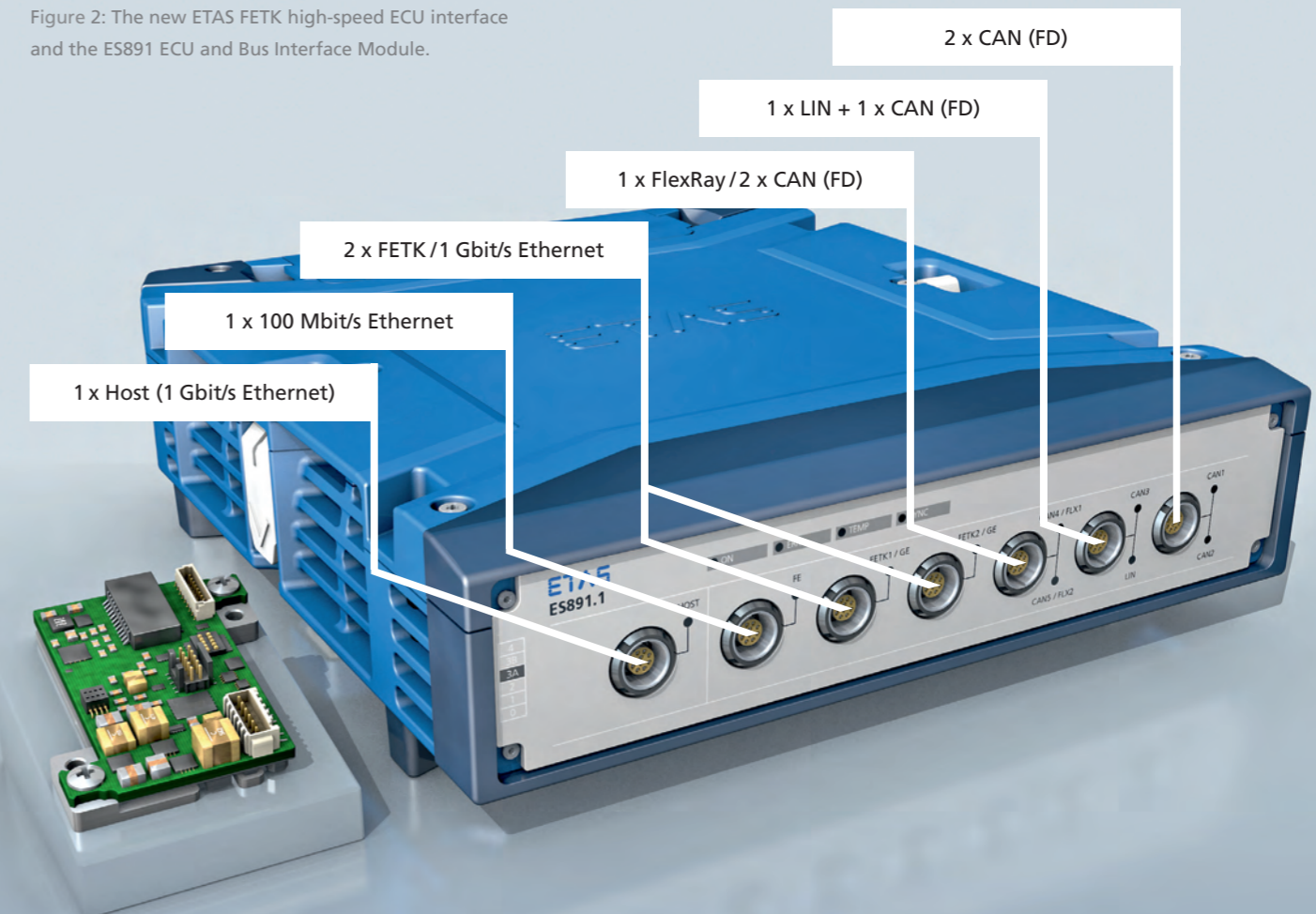
The ES89x ECU and Bus Interface Modules – open and standards-compliant

- The new ES89x modules are compatible with the existing ETAS product families of the ES400/ES600 measurement modules, the XETK ECU interfaces, the ECU and bus interface modules of the ES51x/ES52x/ES59x series, and the prototyping and interface modules of the ES9xx series. On the basis of Ethernet, custom hardware can also be easily integrated with the new modules.

- The ES89x modules offer native support for the XCP-on-Ethernet protocol enabling both ETAS and third-party software applications to communicate via the standardized protocol with electronic control units with FETK or XETK interfaces.

- Time synchronization that conforms to the IEEE1588 standard simplifies the integration of the ES89x modules in heterogeneous test setups and automation solutions by means of a centralized clock.

- ETAS provides libraries for the integration of the ES89x modules' bus interfaces into other tools, such as CANape or VISION.

The prototyping hardware communicates with an ECU with FETK interface in real time via an ES89x module. This enables modifications to new software control functions and allows for immediate validation of these functions in the vehicle or on the test bench. Time-critical control functions require that bypass signals flow between the prototyping hardware and the ECU with the smallest possible latency. The FETK interface with the ES89x ensures the exchange of a 128-byte signal circulating from the prototyping hardware to the ECU and back with a latency of less than 100 μs.

Next generation ECU and bus interface

Thanks to the winning combination of a high data transfer rate, low latency, and easy integration into new ECUs, the FETK interface can be used almost anywhere. Excellent cooperation between ETAS and chip manufacturers, such as Freescale, Infineon, and Renesas, also makes it possible to adapt the interface to new microcontrollers. The FETK hardware offers users the utmost in operating convenience: since the Gigabit-Ethernet connection to the ES89x modules is generic, the latter can be seamlessly integrated in all FETK ECU projects without requiring any further configuration. The new ES89x ECU and Bus Interface Modules acquire measurement data from ECUs and vehicle buses to support the calibration, diagnostics, flash programming of ECUs, and prototyping of new ECU functions.

The ES89x enables the user to directly connect two FETK interfaces for these purposes. What is more, the ES891 and ES892 modules support XETK and the Ethernet, FlexRay (ES891), CAN, CAN-FD, and LIN vehicle buses. They synchronously acquire all incoming measurement signals with one microsecond precision.

The ES89x modules are designed to be mechanically stackable, enabling a robust mechanical and electrical connection between modules. If a vehicle has more than two ECUs equipped with FETK interfaces, multiple ES89x modules may be combined to synchronize the data from all connected FETK or serial interfaces automatically. Additionally, expansion is not only possible with ES89x modules but also with prototyping hardware, and data loggers that are currently under development at ETAS. All members of the new ES800 product family will help to secure the functioning of future electronic vehicle systems (Figure 1).

Outlook

ETAS' FETK provides powerful ECU access, making it a solution that is equally suitable validating and calibrating ECUs as it is for developing prototypes of time-critical functions of electronic vehicle systems. Based on this unique combination, a development ECU featuring an FETK interface pays off twofold: in calibration and in prototyping.

In addition, the ES800 product family will be augmented in the coming months by powerful and flexible prototyping hardware and a comprehensive data logger solution. The latter will make it possible to record ECU software variables and serial data bus signals for an entire day of testing without interruption.