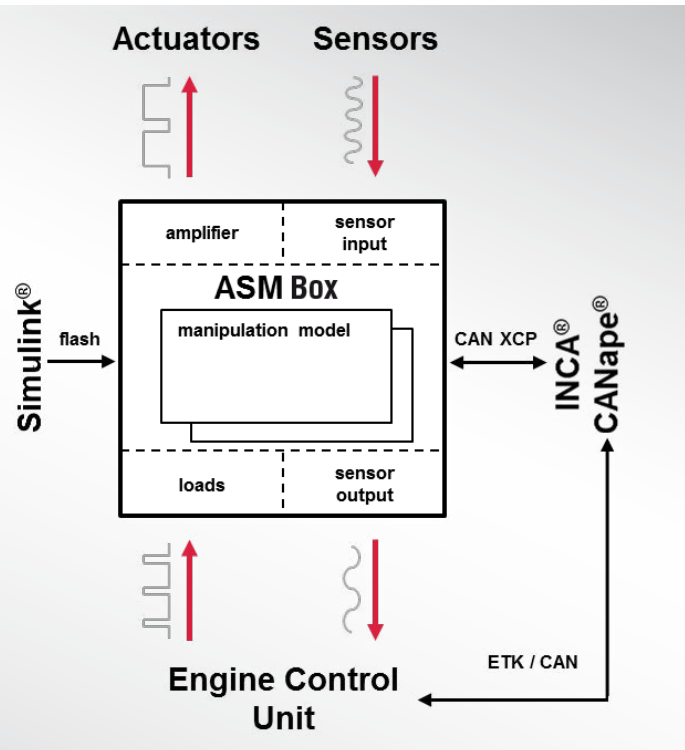


# MODEL-BASED AUTOMOTIVE RCP SYSTEM

FEV's TOPexpert ASM Box is based on an automotive RCP system. It allows arbitrary failure patterns of sensors, actuators and/or engine components (e.g. leakage) which are realized by Simulink® models. The behavior of failure models can be controlled during runtime via XCP access by arbitrary calibration tools. The system enables time-synchronous sampling of ECU data and ASM Box data during calibration.



Learn more about the TOPexpert tools and inform yourself about the capabilities and advantages of TOPexpert on our website:

[www.http://www.fev.com/topexpert](http://www.fev.com/topexpert)



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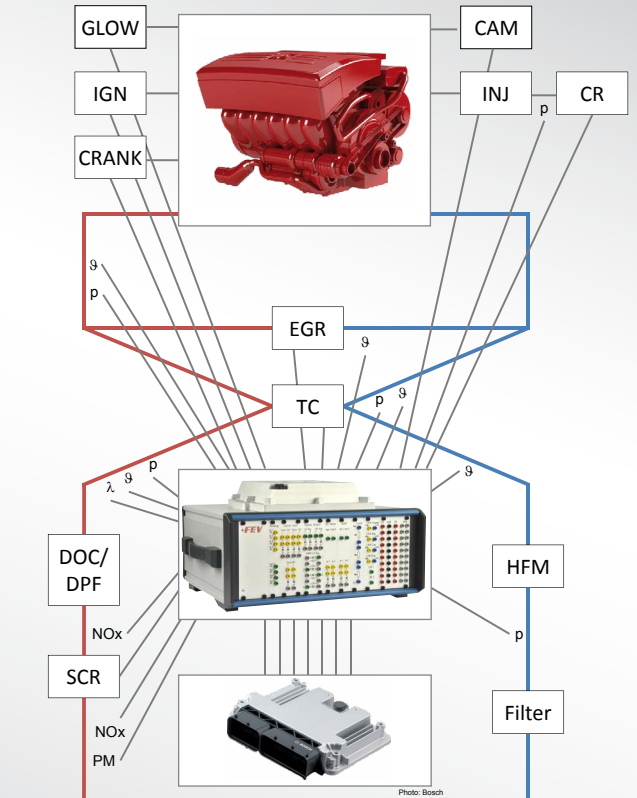
# TOPexpert ASM Box



# SIMULATION OF OBD FAILURE PATTERN FOR HOMOLOGATION AND CALIBRATION

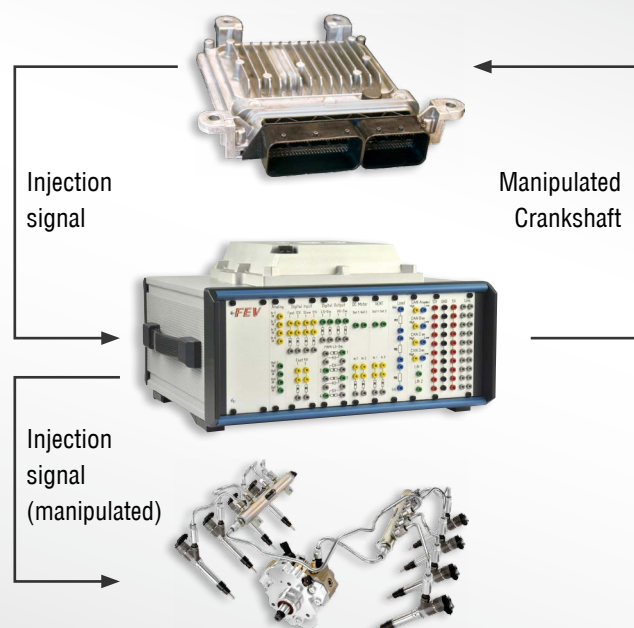


OBD FAILURE SIMULATION BY ELECTRICAL SENSOR AND ACTUATOR MANIPULATION

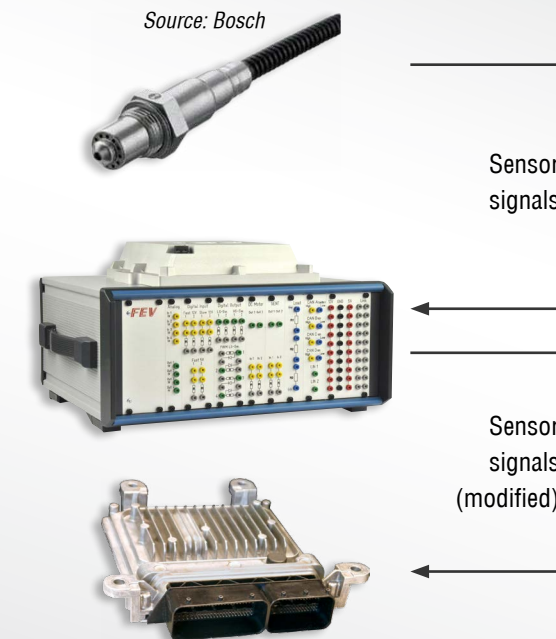


FEV's TOPexpert ASM Box allows the efficient verification of OBD calibration by electrical manipulation of actuator and sensor signals, especially for U.S. homologation with government mode in addition to the common user mode. Because no faulty hardware is required for failure generation it achieves cost savings of 20 percent in typical use cases. Using the ASM Box during calibration improves quality and efficiency. Easy to use software combined with MATLAB SIMULINK® allows development of own failure models.

## MISFIRE SIMULATION



## MANIPULATION OF OXYGEN SENSOR SIGNALS



### EXAMPLE: INJECTION AND IGNITION

- > Turn off injection and ignition in different use cases (randomly, equally spaced, continuous)
- > Shifting start angle of injection and ignition (constant offset or dynamic manipulation)
- > Change injection duration (constant offset or dynamic manipulation)
- > Every injection manipulation is possible for up to five injections per stroke

### EXAMPLE: CRANKSHAFT SENSOR

- > Manipulation of the crankshaft signal to create various failures (omitting several teeth/signal edges, tooth displacement, missing teeth)

### ASM Box 2.0

I/O type	Number
Analog	3 x Analog in, 0..5V 3 x Analog out, 0..5V
PWM	4 x PWM in, 5/12V/24V-logic 4 x PWM out
DC motor	1 x DC Motor in 1 x DC Motor out
SENT	2 x SENT in 2 x Sent out
Speed sensor (inductive/TTL)	1 x in 1 x out
Injectors	6 x in 6 x out
Ignition signal (TTL)	6 x in 6 x out
CAN	4 ports (1 for calibration access)
LIN	2 ports
Master/Slave	Multiple boxes for more I/O

### SUMMARY OF ALREADY REALIZED MANIPULATION PATTERNS

Type	Description
EGR-HF	PWW signal & analog signal
EGR-LF	SENT protocol
Air flap	PWM signal & analog signal
Rail pressure	Analog signal
Temperature	PT 1000 resistor
NO <sub>x</sub> sensor	CAN protocol
PM sensor	CAN protocol
Delta P sensor	SENT protocol
Mass air flow	PWM signal & frequency modulation
Injection	Solenoid injectors w/internal amp Piezo injectors w/external amp
Camshaft	Sensor signal
Camshaft	VVT manipulation via PWM signal
Crankshaft	Sensor signal
Ignition	PWM signal and frequency
Throttle valve	PWM signal
Misc.	Misc. signal generation possible

The new ASIC CJ135 becomes more and more relevant and new types of lambda probes e.g. LSU 5.1 from Bosch require higher complexity of systems for lambda manipulation during homologation. FEV's ASM Box is worldwide the first system to manipulate the signal for this combination of ASIC and sensor.

### EXAMPLE: OXYGEN SENSOR MANIPULATION

- > Fault indicating insufficient lambda sensor dynamics (lean to air)
- > Measured oxygen concentration implausibly high compared to model oxygen concentration
- > Manipulation of ceramic temperature signal or heater duty cycle
- > Signal-, Max- and Min-Error (SCB) LSU Heater Powerstage
- > Lambda sensor wire diagnosis open load at pin IPE
- > Lambda sensor wire diagnosis short circuit to battery and ground