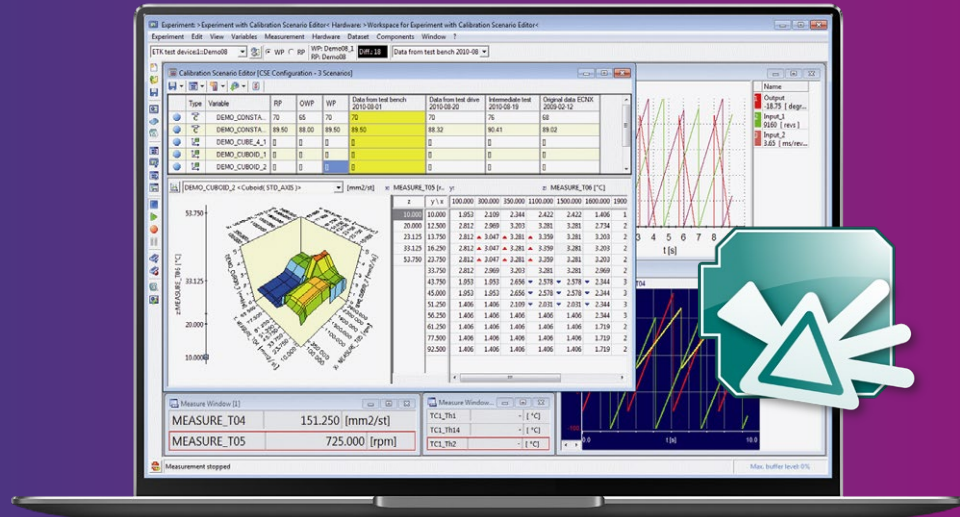


Integrated measurement and calibration environment INCA



Capture of measurement data, ECU calibration, and diagnostics

ETAS supports and facilitates the development of software-defined vehicles (SDV). INCA comes with the following features:

Areas of application

- Time-synchronous signal capture from ECUs, vehicle buses, sensors, and other sources in the vehicle environment
- Online and offline calibration of ECU data
- Simultaneous capture of diagnostics data
- Flashing of ECU code and data
- At the desk, in the lab, on the test bench, and in the vehicle
- Offline administration of calibration data, analysis of measurement data, PC-based simulation, vehicle instrumentation

Functions

- Ergonomic experimentation environment with virtual oscilloscopes, display of measurement values, and calibration editors
- Compatible with all interface, measurement, and drive-recorder modules from ETAS
- Compatible with all common calibration standards (e.g., ASAM, AUTOSAR) and data formats
- Integrated tools for administration of calibration data, analysis of measurement data, and Flash programming
- Consistent, database-driven administration of user data

Benefits

- Custom-built tools for the efficient calibration and validation of ECUs
- Offline preparation for optimal work organization
- Open, standards-compliant interfaces for automation
- Easy integration in large number of applications via COM-API and high-performance MATLAB® interface
- High versatility through compatibility with ECUs from all manufacturers
- Efficient working through reuse of existing workspace elements

INCA product family

Use cases

Test bench

The test bench provides a stable environment for testing and optimizing engines and ECUs. Both testing and calibration can be fully automated. The test bench simulates the ambient conditions for the engine and influences the ECU via INCA. The incorporation of ASAM protocols ASAP 3 and MCD-3MC along with the high-performance interface ASAM iLinkRT provides simple connectivity to the test bench systems of all major manufacturers.

Offline

Testing can be prepared offline. This ensures the most efficient use of available resources such as test vehicles and test benches. Using INCA, it is possible to configure hardware setups and interfaces without actual hardware access, to select the required measurement and calibration settings, and to allocate recorders. Tests prepared in this way can be run at the press of a button, thereby saving valuable time. Results can then be analyzed later and offline via the Measure Data Analyzer (MDA).

Flashing

Before starting work, all ECUs must be updated with the correct software. Data versions should also be backed up in the ECU ROM at regular intervals. INCA's integrated flashing functionality enables easy reading and writing of ECU software and data. The required programming for specific ECUs can be easily performed using a script language.

Automation

Automation of time-consuming, manual tasks improves efficiency and enables the exact reproduction of testing sequences. This saves valuable resources and improves the quality of testing. Using the COM or MATLAB® interface, other programs or scripts can also be used to control INCA. With INCA-FLOW, the calibration engineer is able to describe operating sequences in simple graphical form without the need for programming skills.

In-Vehicle

Calibration involves the measurement of vehicle behavior and the optimization of that performance via the adjustment of specific parameters. This is often performed onboard the vehicle itself. INCA is designed for use in a complex vehicle environment. Measurement and calibration settings are displayed graphically and recorded. Keyboard shortcuts are available for all key operations. Using the INCA-TOUCH add-on, all key functions can be performed via touchscreen.

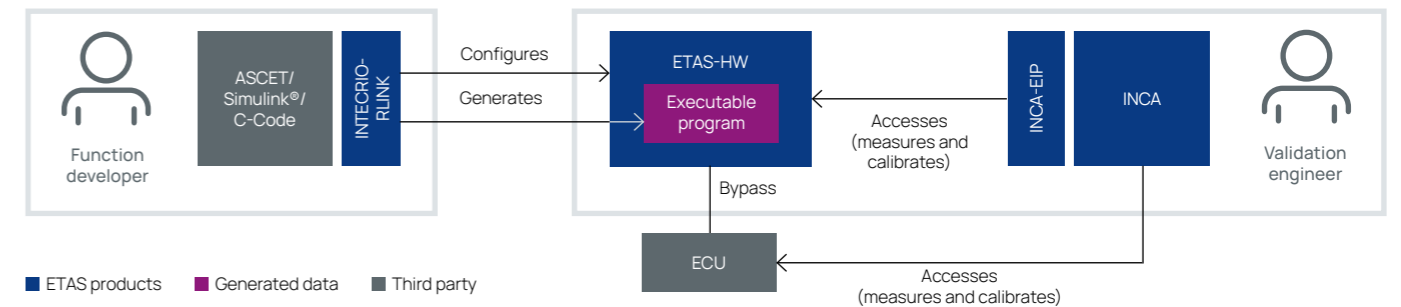
Diagnostics

When verifying diagnostic functions, errors are simulated so as to ensure that all test routines are running correctly. For this purpose, the diagnostic software is suitably parameterized and the fault memory monitored. By means of the ODX-LINK add-on, INCA is able to provide diagnostics in parallel to measurement and calibration functions. This means that diagnostic data from the OBD interface and from the ECUs can be captured and compared using the same hardware.

Use cases

INCA for prototyping and virtualization

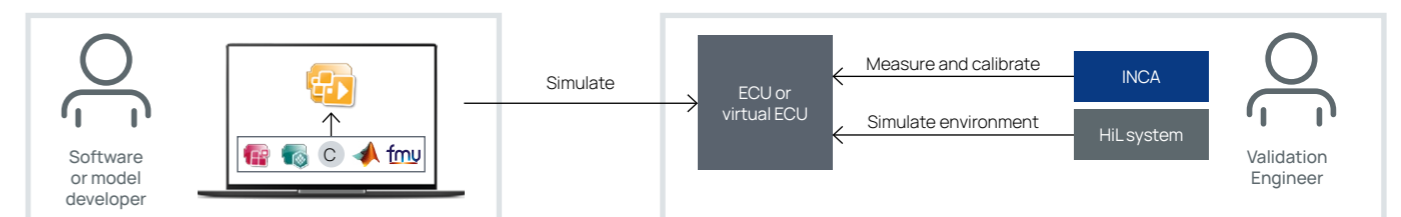
Using INCA for rapid prototyping



The advantage of model-based development is that no actual, costly hardware is required. Yet there are situations when it makes sense to test a model of ECU functions under real conditions. In simple cases, measurement of the model and the real system are performed simultaneously. More interesting, however, is when the model is integrated online in a real system, so that interactions between the two can be observed – as is the case with rapid prototyping. ETAS rapid prototyping hardware creates an interface between the model world and real systems.

INTECRIO enables the user to combine functions based on ASCET, Simulink®, and C code and to run these as prototypes on a PC or on ETAS rapid prototyping hardware. After connecting the prototype function to the ECU by means of a bypass, a validation engineer can then use INCA and INCA-EIP to capture and optimize data from the ECU and from the prototype function.

INCA for testing and validating with XiL systems



ECUs can be tested and validated under real-time conditions by using XiL systems in conjunction with a simulation of the controlled system. ETAS COSYM is a powerful simulation and integration platform that enables the testing and validation of software at the system level.

It supports virtual setups (MiL/SiL) and also real ECUs (HiL). INCA can be used for the measurement and calibration of both virtual and real ECUs.



INCA Base product

Via INCA, it is possible to access a running program in the ECU via any one of a number of interfaces. This means that measurement values can be recorded and parameters adjusted under real conditions. More importantly, it also means that ECU software can be parametrized onboard the vehicle itself while out on the test track. Moreover, INCA can also be used in the modeling phase, when vehicle software

is measured and calibrated via a model. In other words, INCA provides users with the exact same working environment, irrespective of whether they are working on an early design based on a simulation or undertaking fine-tuning in a real vehicle. Naturally, standard INCA functionality also features functions such as ECU flashing, interfaces to test bench systems, the monitoring of vehicle buses, and the recording

of measurement values from connected measurement hardware provided by ETAS or other manufacturers. INCA can be expanded via a whole range of add-ons or combined with other ETAS tools. It is therefore suitable for use in practically all of the use cases related to vehicle software development.



ASCMO

- Precise modeling, analysis, and optimization of complex systems on the basis of less measurement data
- Efficient calibration of physical models
- Powerful optimization procedures and the latest AI methods based on machine learning



EHANDBOOK

- Interactive documentation of ECU software to facilitate rapid understanding
- Seamless representation of function blocks (ASCET, Simulink®, C code) for purposes of signal tracking
- OEM + level 1 ECU software components in a single view
- Automatic generation of INCA experiments and display of online measurement values



MDA

- Visualization, analysis, and further processing of diagnostic and measurement data from ECUs, sensors, and vehicle buses
- Compatible with ASAM MDF and other formats
- Immediate use of current recordings from INCA
- Synchronization with EHANDBOOK-NAVIGATOR



FLOW

- Guided and automated calibration and validation of ECU functions with INCA
- Intuitive graphical modeling of calibration tasks without the need for programming skills
- Support for manufacturers, suppliers, and service providers with the standardization of calibration processes



INTECRIO

- Integration and configuration platform for the prototyping of function models
- Model-based validation of vehicle functions under real conditions
- Powerful onboard simulation performed on ETAS prototyping hardware in connection with production ECUs
- Visualization, measurement, and calibration of model variables via INCA-EIP and a single ECU access



COSYM

- Efficient testing and validation of embedded software in MiL, SiL, and HiL environments
- Moving tests upstream to the simulation level (MiL/SiL) saves time and costs
- Measurement and calibration of COSYM simulations with INCA
- Parallel access to ECU software via INCA



EATB

- Generation of interactive graphical HTML reports based on measurement data
- Configuration in dedicated graphical user interface or in MATLAB®
- Traffic light system to classify threshold events where values are near critical limits and to display timelines
- Optional MDA interface for further, detailed analysis of measurement data

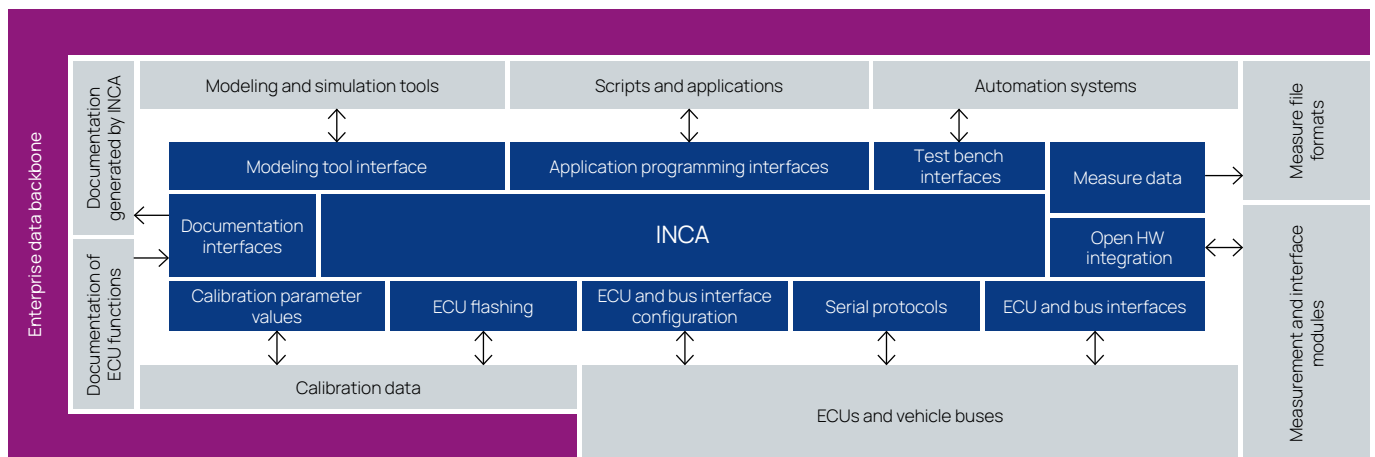
API

- Remote access to INCA via Microsoft®COM server
- Access to INCA database, experiments, hardware configurations, and CDM with customer applications
- Access to INCA from MS Office programs such as MS Excel via Visual Basic for Applications (VBA)



INCA: An overview

Interfaces and add-ons



Optional extensions

| | |
|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| CAN-TRANSMIT | Transmits measurement data from a data source via CAN or CAN FD |
| EHOOKS-CAL/EHOOKS-BYP | Enables activation of hooks in the ECU for looping in parameter values and for bypassing functions in the ECU |
| INCA-TOUCH | Enables the performance of key measurement and calibration functions via touchscreen or voice command |
| INCA-EIP (Experimental Target Integration Package) | Provides access to the rapid prototyping systems ES910 and ES830 and to PC-based virtual prototyping |
| INCA-FLEXRAY (FlexRay Integration Package) | Enables the monitoring of data on FlexRay buses and the measurement and calibration of ECU data via the FlexRay bus |
| INCA-LIN (LIN Integration Package) | Enables the monitoring of data on LIN buses |
| INCA-MCE (Measurement and Calibration Embedded) | Provides, in conjunction with the ES910, the world's fastest access times from test bench to ECU |
| INCA-MIP (MATLAB® Integration Package) | Enables MATLAB® to access measurement signals and calibration parameters from ECUs and to incorporate them in MATLAB® scripts |
| INCA-QM-BASIC (Basic Quality and Maturity Tracking) | Enables documentation and administration of the maturities of calibration data via meta-information in compliance with the ASAM-CDF standard |
| INCA-RDE (Real Driving Emissions) | Provides test drivers with real-time information on the status of RDE measurements during test driving |
| ODX-LINK (Diagnostics Integration Package) | Enables simultaneous ECU diagnostics and capture of internal ECU, bus, and sensor data in the INCA experimentation environment |
| INCA-SIP (Simulink® Integration Package) | Enables interactive measurement and calibration of Simulink® models |