CaliAV® - Guided Calibration for INCA Autopilot to efficient best-practice MCD
CaliAV – Guided Calibration for INCA
What it does for you

.. as calibration engineer
  • Easily automate day-to-day repetitive tasks

.. as manager of a calibration department
  • Deploy best-practice across teams
  • Increase calibration project efficiency

.. as executive manager for automotive electronics
  • Ensure consistent quality results
  • Documented procedures and documented calibration results
ETAS MCD Solutions to optimize the calibration process
Introduction – Continuous engine control complexity increase

Consumption and emission requirements

New layered standard architecture

New functions and variants
In-vehicle Calibration
Managing Complexity

• Despite all automation efforts at test cells, in-vehicle calibration by skilled engineers is indispensable for quality and perception of vehicle performance

• By today, in-vehicle calibration is often:
  • Largely **manually** performed by calibration engineers in test vehicles
  • **Informal** process driven by expert know how
  • **Growing** number of functions through diagnostics and environmental requirements
  • **Increasing** complexity of software control functions
  • **Distributed** know-how across teams
  • Requires **repetition** for software-releases and variants
  • **Narrow** project schedules and reduced test vehicles
  • **Intense** **manual** documentation of work results at delivery

• ECU calibration is becoming one of the major cost drivers in vehicle development

• OEM and Tier1 automate and standardize selected tasks with software solutions
Guided Calibration
Shortcomings of traditional automation approaches

- Software development collides with calibration expertise
  - Skills rarely combined in one person
  - Requirement management from calibrator to developer is required
  - Work procedure becomes software code -> hard to understand
  - IT Support required for calibration departments
  - Software maintenance required (new MATLAB release, for new ECU software releases)
  - Budget required!

- Unsatisfactory flexibility in the car
  - Calibrator has no chance to apply even minor modifications
  - Unclear transparency (black-box) decapitates the expertise of the engineer

- Summary:
  - Although many automation scripts might be available, they get rarely used
  - The day-to-day requirements for automation in the vehicle remain unsolved

“Guided calibration” addresses the automation of routine-tasks and the use of best-practice for calibrators by supporting structured, controlled and repeatable processes
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Solving the calibration trap

Guided Calibration is a revolutionary approach to increase the efficiency of in-vehicle calibration and validation by creating graphical executable-specifications for calibration sequences without programming skills required.

The usage of test-vehicles is reduced, by enabling calibrators to plan and prepare their tasks in the office (Frontloading).

Guided Calibration enables enterprises to establish global best-practice calibration with identical, repeatable results for variants, releases and models.

After standardizing MCD tools, Guided calibration will help our customers to standardize MCD processes.

CaliAV differs from traditional approaches to automation as it does not confine the calibration engineer in the vehicle to a rigid script, but still provides a high-degree of freedom to react to unforeseeable circumstances.
CaliAV – Guided Calibration for INCA Example

**Calibration Task**

- Repeatable measurement for analysis of driving experience with various calibration sets (Dashpot)
- Reliable comparison of different vehicles or different components in one vehicle

**Realization**

- Automated vehicle acceleration to a set-point RPM
- Automated modification of throttle dynamic (PWG*-Dynamik) at target RPM (PWG = 0 %)
- Automated modification of thrust calibration data

* PWG = Pedalwertgeber
CaliAV – Guided Calibration for INCA Example

**Calibration Task**
- Automated calibration of idle speed governor with „Ziegler Nichols Method“
- Documented confirmation of improved calibration quality
- Reproducible calibration methodology
- Reduced calibration time

**Realization**
- Measurement of current behaviour
- Stepwise increment of governors P-component
- Engine stimulation by tip-in
- Identification of critical amplification
- Calculation governor parameters
Guided Calibration
Structuring the calibration process

**Design**
- Planning & Design of the required work steps for the calibration task

**Modeling**
- Graphical modeling with ready-to-use building blocks for automotive calibration task

**Implementation**
- Generation of stand-alone executable for distribution

**Execution**
- Online calibration/validation in the vehicle or at the test bed

**Documentation**
- Detailed preparation of calibration and validation work in the office

- Less time in vehicle required
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Application areas - Online

INCA
Read measurement data

CaliAV
Write calibration data

ETK, CAN, FlexRay
ECU/TCU
etc

Emission / Fuel consumption
Exhaust gas treatment
Control Mechatronic Systems
OBDI OBDII

Driveability
Combustion control
Power/ Torque Optimization

AND Offline work
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Product Demonstration
CaliAV V2.0
Project Management
CaliAV V2.0
Process Design

- Library with basic methods
- Context-sensitive help per method
- Sequence Modeling
- Ready-to-Use Toolboxes and Custom libraries
CaliAV V2.0
Interpreter

Monitoring & Debugging
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Features 1/2

**Graphic Design Editor** - Easy & intuitive graphical modeling environment to describe the calibration sequence:
- Calibration becomes easy understandable for everyone
- Calibrators do not require help from software developers
- Modifications can be quickly amended
- Almost independent from the software release

**Libraries** - Out-of-the-box, automotive method blocks in an extensible repository
- High productivity for modeling sequences
- Re-use of existing knowledge for the development of new sequence
- Interface to MATLAB®
- Additional toolboxes for optimization, data analysis or function design

**Interpreter** - Easy execution of the designed sequences
- ETAS INCA is remote-controlled to execute the sequence
- Automation sequences and manual operation of INCA can be mixed
- Easy testing during the development of sequences through step-by-step execution
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Features 2/2

**Project Management** - Management of software projects, calibration sequences and aliases
- Easy administration of projects and sequences
- Definition of alias to provide meaningful names for cryptic labels

**Compiler** - Generation of stand-alone executable scripts
- Approved and tested sequences can be compiled and distributed to users w/o CaliAV license
- Sequences can be distributed without jeopardizing intellectual property

**Configuration** - Build-in configuration management
- Connection to ETAS INCA independent from the software release
- Additional MC devices
CaliAV - Guided Calibration für INCA
Product Portfolio

- Base product with project configuration, process creation and execution
- Topic-focused extensions with additional capabilities
- Process execution with INCA, w/o additional licenses
- Product trainings
- Engineering services for creating calibration sequences and process consulting
Guided Calibration
Benefits

- From calibrators for calibrators!
  - Easy creation of work procedures by calibration experts

- Improved calibration quality
  - Reduction of calibration errors
  - Validation of work results

- Effortless repeatability
  - Reproducible results for each control function
  - Easy reproduction of measurements
  - Easily repeatable for each variant

- Reduced vehicle-usage
  - Planning of calibration tasks in the office

- Process Documentation
  - Improved skill-up phase for new calibrators
  - Global best-practice for all ECU/Software releases / functions
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Thank you for your attention

Please visit http://www.etas.com/de/products/CaliAV.php for more information

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