ETAS INCA-FLOW V4.18

Getting Started

www.etas.com

ETAS INCA-FLOW V4.18 | Getting Started R01 EN | 11.2024

Contents

1 Introduction

This part features all safety-relevant instructions and regulations. Please read this section carefully. Also inform your colleagues who work with INCA-FLOW.

1.1 Intended Use

INCA-FLOW is only intended for calibrating electronic control units regarding engineering tools such as INCA. Any other use of this engineering tool for any activity whatsoever is a misuse of the intended deployment of this tool and IAV Products assumes no responsibility whatsoever in the event of misuse or an accident resulting in death, personal injury, or damage to property. INCA-FLOW permits the graphic modelling and automation of the calibration process. It can be used for component tests and driving profiles, through to extensive measurement data analysis.

> **NOTE**
>
> This document only describes INCA-FLOW. Information about the correct use of INCA can be found in the corresponding manuals.

1.1.1 Obligations and Liability

Knowledge of the basic safety instructions and regulations are vital for the safe use of INCA-FLOW. This manual and in particular the safety instructions must be observed by everyone working with INCA-FLOW.

INCA-FLOW has been developed and programmed according to state-of-the-art engineering.

Even so, it is possible for the user and third parties to be exposed to danger during its use and damage to property can occur. For these reasons, INCA-FLOW must only be used for its intended purpose and when in a perfectly safe condition.

1.2 Target Group

This software product and this user guide address qualified personnel working in the fields of automotive ECU development and calibration, as well as system administrators and users with administrator privileges who install, maintain, or uninstall software. Specialized knowledge in the areas of measurement and ECU technology is required. This includes calibration procedures, software such as INCA and MDA and software algorithms of systems you would like to calibrate.

1.2.1 User’s Qualifications

INCA-FLOW and this manual address qualified staff trained in the development and calibration of automotive control units. The INCA-FLOW user is expected to have corresponding knowledge in measurement and control unit technology. Similarly, basic knowledge in using a PC and working with the Windows operating system is also necessary.

INCA-FLOW users should be familiar with electronic management systems and their calibration. This includes calibration procedures, software tools (such as INCA and MDA) and the software algorithm of the systems they would like to calibrate. INCA should be installed on and configured to the system being calibrated.

1.3 Classification of Safety Messages

Safety messages warn of dangers that can lead to personal injury or damage to property:

 DANGER

DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.

 WARNING

WARNING indicates a hazardous situation that, if not avoided, could result in death or serious injury.

 CAUTION

CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE indicates a situation that, if not avoided, could result in damage to property.

1.4 Safety Information

1.4.1 Licensing as Test Vehicle

The vehicle must be specially licensed as test vehicle when used on public roads. Any normal approval becomes null and void and there is no insurance protection. If the vehicle is not licensed as a test vehicle, it must not be used in road traffic.

1.4.2 General Safety Information

INCA-FLOW is a development software for calibration activities. Calibration activities govern the behaviour of a control unit and the systems influenced by the control unit. These activities can produce unexpected vehicle behaviour, increasing the risk of accidents. Arbitrary intervention in the control units of the distributed electronic vehicle components can trigger unexpected vehicle reactions, such as swerving, braking or acceleration.

 **WARNING**

Risk of unexpected vehicle behavior

Calibration activities influence the behavior of the ECU and the systems that are connected to the ECU.

This can lead to unexpected vehicle behavior, such as engine shutdown as well as breaking, accelerating, or swerving of the vehicle.

- Only perform calibration activities if you are trained in using the product and can

assess the possible reactions of the connected systems.

- Do not use INCA-FLOW for taking on safety-relevant functions in a vehicle.
- Make sure that the vehicle is equipped with an emergency stop button.

WARNING

Risk of accident due to distraction from driving

Operating INCA-FLOW can distract the driver.

The vehicle must always be operated by at least two persons: one to drive the vehicle, and the other to take care of calibration or operation of INCA-FLOW.

WARNING

Risk of accident due to not sufficiently fixed equipment

Emergency brakes or sudden evasive maneuvers can lead to equipment flying through the car.

Fix and secure all calibration hardware in the vehicle in such a way that it cannot work loose.

1.4.3 INCA-FLOW Safety Devices

INCA-FLOW offers the following additional safety devices:

- The INCA-FLOW interpreter has an emergency button (see Interpreter). It resets the control unit to its condition before the particular calibration (switching from the working page to the reference page). In INCA-FLOW, this emergency button is a pure software button and does not relieve you of the obligation to install an emergency stop button in the vehicle.
- As soon as a process modelled in INCA-FLOW is supposed to actively access the control unit, on saving this process you will be asked to assign a safety level and describe the effects of the process. On starting the process later on, you will see a warning message with the description you have given and the safety level. See Save process.

NOTE

You can stop the “Interpreter” by an emergency button or with a shortcut key (see Interpreter), even while other dialogs have the input focus. INCA-FLOW checks at start-up, if another program has already assigned the currently defined shortcut key combination for the emergency stop. If this case occurs, a dialog appears asking you to select a different shortcut key combination. It is advised to check the functionality prior running an online process.

1.5 Privacy Notice

Your privacy is important to ETAS so we have created the following Privacy Statement that informs you which data are processed in INCA-FLOW, which data categories INCA-FLOW uses, and which technical measure you have to take to ensure the users privacy.

Additionally, we provide further instructions where this product stores and where you can delete personal or personal-related data.

1.5.1 Data Processing

Note that personal or personal-related data respectively data categories are processed when using this product.

The purchaser of this product is responsible for the legal conformity of processing the data in accordance with Article 4 No. 7 of the General Data Protection Regulation (GDPR). As the manufacturer, ETAS GmbH is not liable for any mishandling of this data.

1.5.2 Data Categories

Note that this product particularly records the following personal or personal-related data respectively data categories for the purposes of assisting with troubleshooting:

- Communication data: IP address, date and time
- User data: The user's Windows UserID

At run-time, the following personal or personal-related data respectively data categories are recorded for the purposes of assisting development:

- Calibration process design related data, see Storing and Deleting Personal or Personal-Related Information: Windows User Data.

When using the ETAS License Manager in combination with user-based licenses, particularly the following personal or personal-related data respectively data categories can be recorded for the purposes of license management:

- Communication data: IP address
- User data: UserID, WindowsUserID

When using this product and, where necessary, with the aid of other add-ons, further personal or personal related data respectively data categories can be recorded for the purposes of further analysis. This may, for example, include vehicle identification numbers (VIN) or vehicle number plates as well as GPS, video, audio, or other measuring data. The exact data recorded in each case is determined by you when you configure your measuring system. Note that, in such cases, you are responsible for the legally compliant handling of the data in accordance with applicable national law.

1.5.3 Technical and organizational measures

This product does not itself encrypt the personal or personal-related data respectively data categories that it records. Ensure that the data recorded are secured by means of suitable technical or organizational measures in your IT system, e.g., by using classic anti-theft and access protection on the measurement hardware. Personal or personal-related data in log files can be deleted by tools in the operating system. For the procedure of deleting personal or personal-related data in measure files, see links below.

1.5.4 Storing and Deleting Personal or Personal-Related Information: Windows User Data

INCA-FLOW uses the Windows user information to allow the identification of who produces an output. The following output files are using Windows user information: INCA-FLOW database (*.sdb), project configuration (*.prj.cal) and process files (*.prc.cal, *.si.cal).

Purpose

In INCA-FLOW, you can create, import, and export databases, project configuration and process files, which store personal data of Window users to have the opportunity to identify later each individual user who has created a specific of those above mentions files.

Personal Data

In the INCA-FLOW Database Browser, INCA-FLOW offers the possibility to create, save, im- and export database, project configuration and processes. These files contain your personal windows user data information.

Location

INCA-FLOW Database (*.sdb):

You find the created *.sdb files on the disc drive under your ETAS\INCA-FLOW X.Y\db location as default location and for the backup of the database under ETAS\INCA-FLOW X.Y\Backup. The import and export database storage can be found under the drive chosen by the customer during the im- and export process. The database contains the Windows user account id of the author of process configurations and processes. This information is included in a database export file.

INCA-FLOW Project configuration (*.prj.cal):

Project configurations are usually stored in the database (*.sdb). The import and export of a process configuration file (.prj.cal) can be found under the drive chosen by the customer during the im- and export process. When exporting a project configuration, the respective Windows user account ids of the authors of containing project and processes will be stored in the project configuration export file. When importing a project configuration, the Windows user account ids of the users who created originally the project and processes in this project configuration will be shown to the person importing the respective project configuration. If a project configuration contains processes from more than one Windows account id, all respective user ids will be shown during the import of the project configuration for the respective process.

INCA-FLOW processes (*.prc.cal):

The processes are usually stored in the database (*.sdb) within a project configuration. The import and export of a process file (.prc.cal) can be found under the drive chosen by the customer during the im- and export process. When exporting a process, the respective Windows user account id will be stored in the process export file. During the import of this process, the Windows user account id of the person who created originally the process will be shown to the person importing.

Deletion

Delete the database file, the project configuration file and/or the process file in the respective folder (see above).

Logfiles during INCA-FLOW and INCA-FLOW interpreter execution

Purpose

INCA-FLOW creates, during the execution of the INCA-FLOW designer and the interpreter execution, log-files containing the Window account id to use those log files for debugging purpose of the software development. INCA-FLOW uses this information for the Zip and Send to the ETAS Hotline.

Personal Data

The log files containing the personal Window account id of the user.

Location

The log files are stored under your ETAS\INCA-FLOW X.Y\logs location as default location.

Deletion

Delete the log files in the respective folder (see above).

Logfiles collected within INCA-FLOW (Collect logfiles)

Purpose

INCA-FLOW allows a collection of all log-files of INCA-FLOW initiated by the user of INCA-FLOW containing the Window account id to use those log files for debugging purposes of the software development. These collected log files will be zipped and then sent to the ETAS Hotline.

Personal Data

The log files containing the personal Window account id of the user.

Location

The log files are stored under your ETAS\INCA-FLOW X.Y\logs location as default location.

Deletion

Delete the log files in the respective folder (see above). Do not send the automatically opened email.

2 About INCA-FLOW

This part contains information about INCA-FLOW. INCA-FLOW is a process-oriented tool to help engineers meet increasing challenges in the ECU development process. Given the continuing trend in the automotive industry to implement increasingly complex control functions, to shorten deadlines and to strive for quality improvements, these are also the basis for optimizing INCA-FLOW. INCA-FLOW utilizes the industry-standard calibration software to enhance efficiency by automating the calibration procedure for ECUs.

2.1 Calibration with INCA-FLOW

The need for this kind of automated calibration system is caused by:

- Increased calibration complexity
- New functions
- Diagnostics
- Legal requests
- Increased functional complexity
- New controller structures
- Model-based algorithms
- More stringent quality requirements
- Quality depends on the calibration engineer
- Limited reproducibility
- Documentation

The calibration process of finding the optimum values for parameters often necessitates a “Trial-and-error” approach, consisting of considerable test iterations (next Figure). This is undeniably a time-consuming method especially when calibrating a function with today´s complex algorithms. The efficiency and quality of work highly depend on the timeline and on the experience of the calibration engineer. Even so, this approach is still being widely used by calibration engineers.

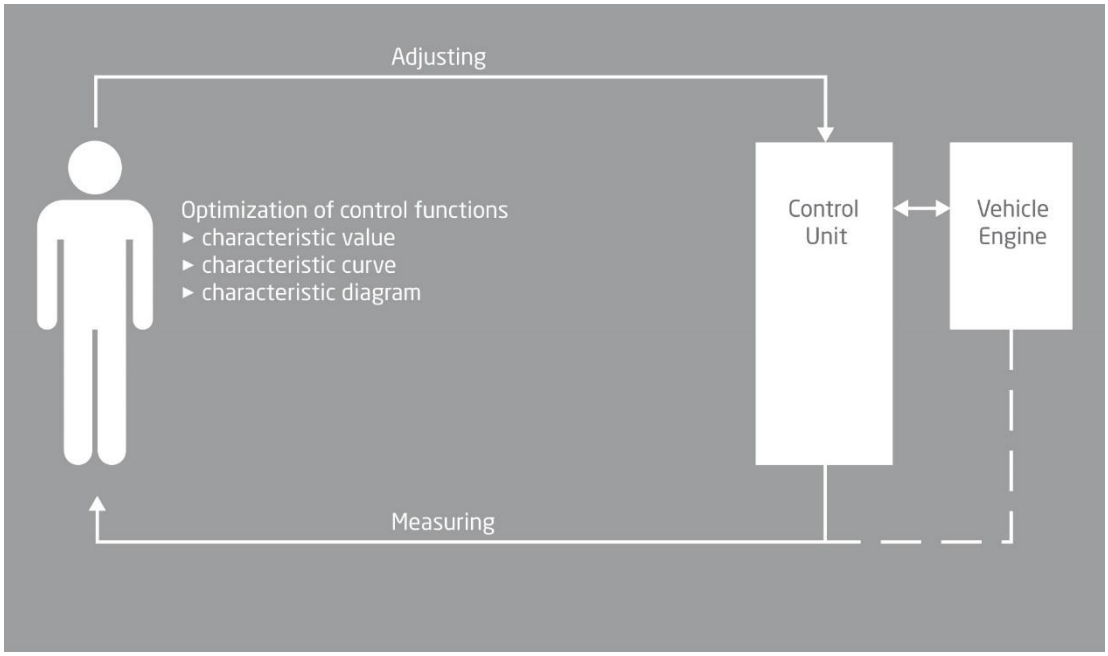

Figure 1: Conventional calibration method

With INCA-FLOW, the user models the calibration process offline. The same calibration process can of course be reproduced for the relevant control functions in other projects.

Subsequently, INCA-FLOW will seamlessly automate the measurement and calibration of the control unit online via INCA when the engineer returns to the test vehicle (Figures Calibration using INCA-FLOW and Flowchart of automated calibration process).

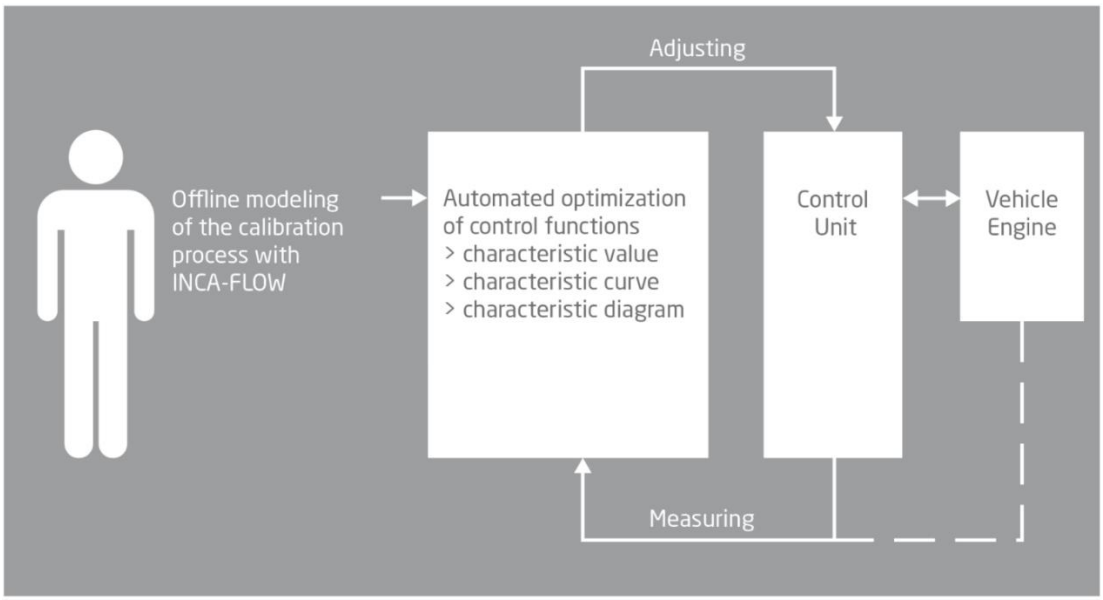

Figure 2: Calibration with INCA-FLOW

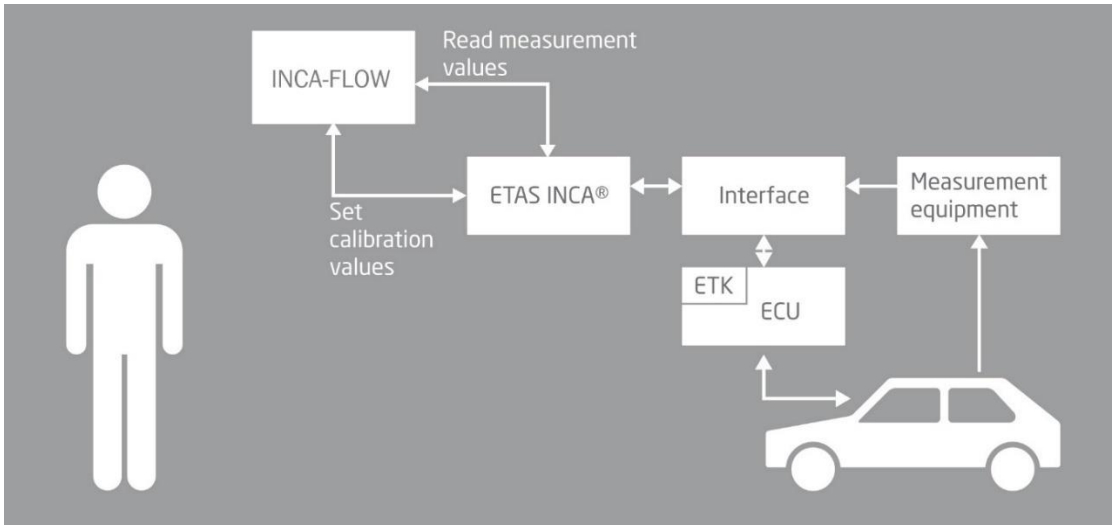

Figure 3: Flowchart of automated calibration process

The general benefits of the INCA-FLOW-based calibration process are as follows:

Consistent and improved calibration quality

- Reproducible with same functions
- Fault minimization
- Reproducible measurement

- Validation of calibration
- Reduced calibration time
- Automation complexity defined by the calibration engineer

Process-oriented documentation of calibration

- New employees familiarized more quickly with the calibration process
- Standard process established for engine test bench calibration and vehicle calibration
- Similar and/or identical calibration processes implemented for new software/ functions/EMS

The tool structure of INCA-FLOW can be divided into three separate parts:

- Project and Process Management
- Graphical Editor
- Interpreter

2.2 General Information

INCA-FLOW is an engineering tool running under the Windows operating system (Windows 10). These operating systems are not real-time systems. INCA-FLOW therefore cannot be assured to have the performance and repeatability of a real-time system. The reproducibility and speed of a command from INCA-FLOW for changing a parameter or reading out measurement parameters in online mode largely depend on the reproducibility and speed of the access commands from INCA to the calibration ECU (ETK, CCP, etc.) and cannot be guaranteed. Benchmark measurements have shown a minimum access time of around 100 ms, which may differ from time stamp to time stamp.

The language of some dialogs (e.g., for loading and saving files) depends on the native language of the operating system. The figures in this manual show a German operating system.

2.2.1 Variables and Numeric Values

Numeric values of the INCA-FLOW FLOAT data type are stored as IEEE 754 numeric standard 64-bit real numbers (C-double): sign bit, 11-bit exponent, 52-bit mantissa. This means that all mathematic calculations using such numbers in a process are subject to a rounding error, which may not be visible as the display setting of the variable reduces the post-decimal digits. Be aware, however, that the result of complex mathematical methods like “Polyfit” (that uses the Gauss algorithm to solve a system of linear equations) might be slightly imprecise character values in calculations - If a character value is encountered during a mathematical calculation (e.g., a STRING variable is used as an argument for a calculation method) a warning will be displayed and a numeric value of 0 (zero) is assumed at run-time.

If a matrix is indexed with square brackets, the result is always a matrix with corresponding dimensions.

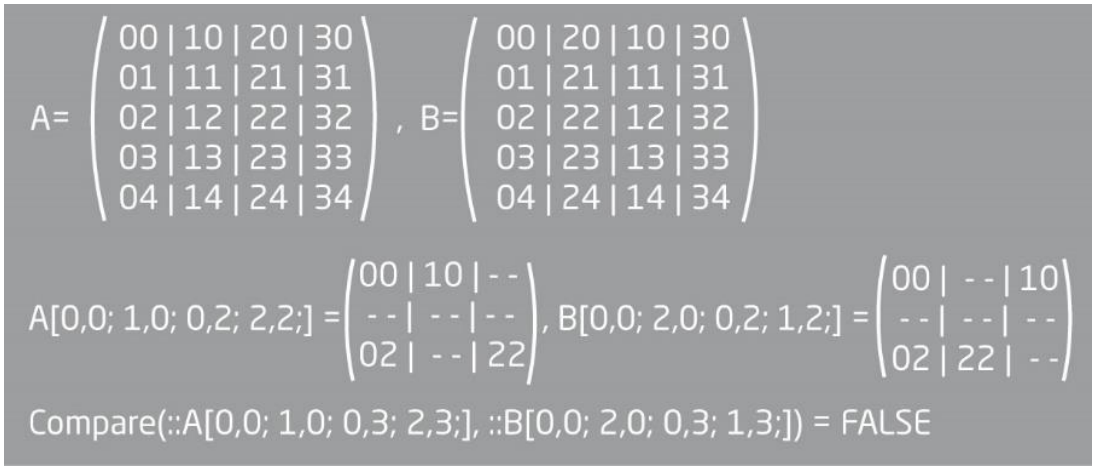

Figure 4: Example 1

These matrix ranges are not equal, because the values are at different positions.

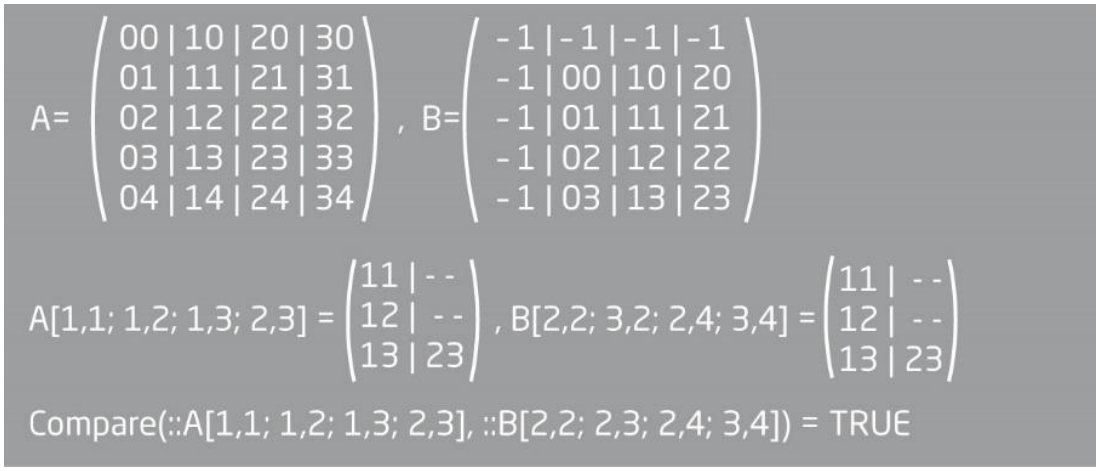

Figure 5: Example 2

These matrix ranges are equal because the values are at same positions.

Elements that are to be replaced by their current value at run time are marked with two leading double points (::) and a trailing semicolon (::element;). It is possible to resolve an element more than once by prepending additional double points before the name. This is only useful for user-defined STRING elements containing other element names.

The following figure shows such a principle:

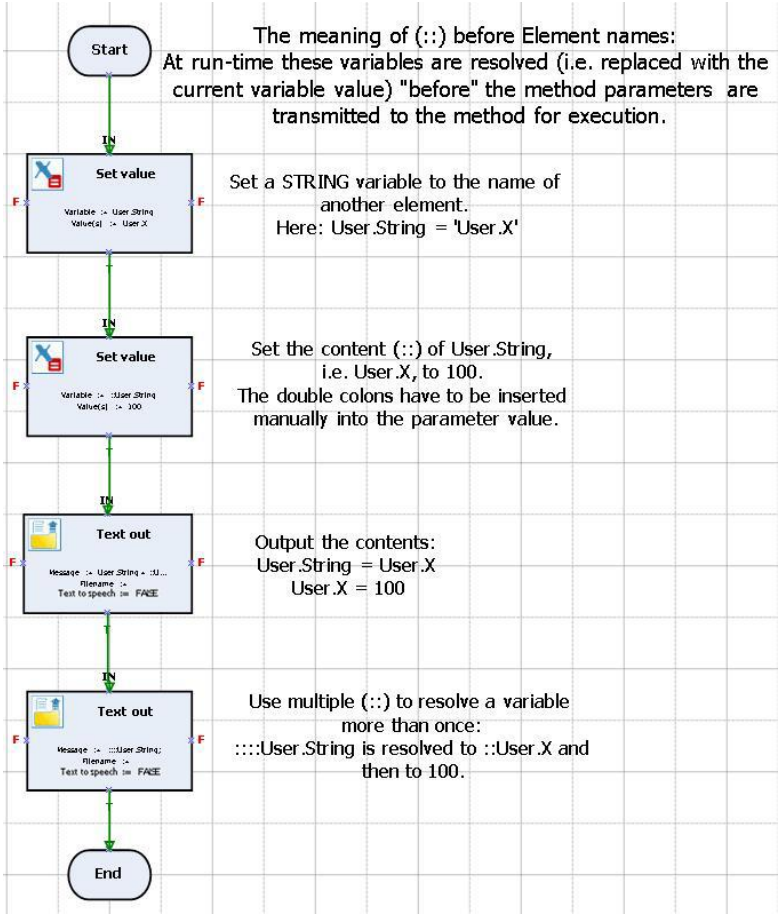

Figure 6: Element resolving

2.2.2 Communication with INCA

Closing INCA manually interrupts communication between INCA-FLOW and INCA. As a result, you might have to restart INCA-FLOW. While accessing INCA from INCA-FLOW, the user management in INCA is disabled.

INCA does not notify external COM clients (i.e., INCA-FLOW) automatically of occurring events like a disconnection of its hardware or other communication errors. These kinds of events are detected by trying to access ECU memory via INCA. The result is a failure message during run-time of the process.

On systems with two INCA versions (e.g., INCA 7.3 and INCA 7.4) you are able to access the INCA 7.3 - database with the INCA 7.4 engine. Please be aware that in such a case, INCA will possibly update the database structures for experiments and workspaces without notification so that access from a former version will not be possible anymore.

Please make sure that all hardware devices, which have been configured under INCA, are also connected during runtime of INCA-FLOW with processes that are changing calibration parameters. INCA is trying to communicate permanently with all configured hardware devices. This communication between INCA and the hardware devices has obviously a higher priority in INCA than a command to change a calibration parameter. If the configured hardware devices are not connected to INCA, high differences in the timing of changing calibration parameters might be possible.

Map dimensions can differ between INCA-FLOW and INCA so that the INCA-FLOW methods can unintentionally result in map manipulations beyond the map size. To avoid this, the maps or methods used must be checked accordingly, i.e. by synchronizing the calibration elements with the INCA experiment data. INCA-FLOW cannot change the size of calibration maps and curves.

3 Installation

This part tells you how to install INCA-FLOW.

3.1 System Requirements

This part contains information about the requirements for using INCA-FLOW and the functionality of INCA-FLOW.

3.1.1 Hardware Requirements

	Minimum System Requirements	**Recommended System Requirements**
General hardware	▪ Network adapter ▪ DVD-ROM drive (in case of installation from DVD)	▪ Network adapter ▪ DVD-ROM drive (in case of installation from DVD)
Processor	▪ 2 GHz	▪ 3 GHz quad core processor or equivalent
RAM	▪ 2 GB	▪ 16 GB
Graphics card	▪ Resolution of at least 1024 x 768, ▪ 256 MB RAM ▪ 16-bit color and DirectX	▪ Resolution of at least 1280 x 1024 ▪ 1 GB RAM ▪ 32-bit color and DirectX 9
Required free disc space	4 GB (not including the size for user data)	▪ > 4 GB (not including the size for user data)
Operating system	▪ Windows® 10 (64-bit) ▪ Windows® 11 (64-bit)	▪ Windows® 10 (64-bit)
	English, French, Japanese, Chinese, and German operating systems are supported.	
Performance Recommendations	▪ More Memory improves execution time of repetitive operations ▪ SSD hard disks improve the file access times	

NOTE

INCA V7.3 and higher supports the 64-bit operating system only.

3.1.2 Software Requirements

INCA-FLOW processes are managed by integration with an SQLite database. Utilization of the SQLite database is therefore mandatory. The following figure illustrates the relationship between the different components and functions of the INCA-FLOW software and how they interact with the database. Each component will be explained in greater detail further on in this user manual.

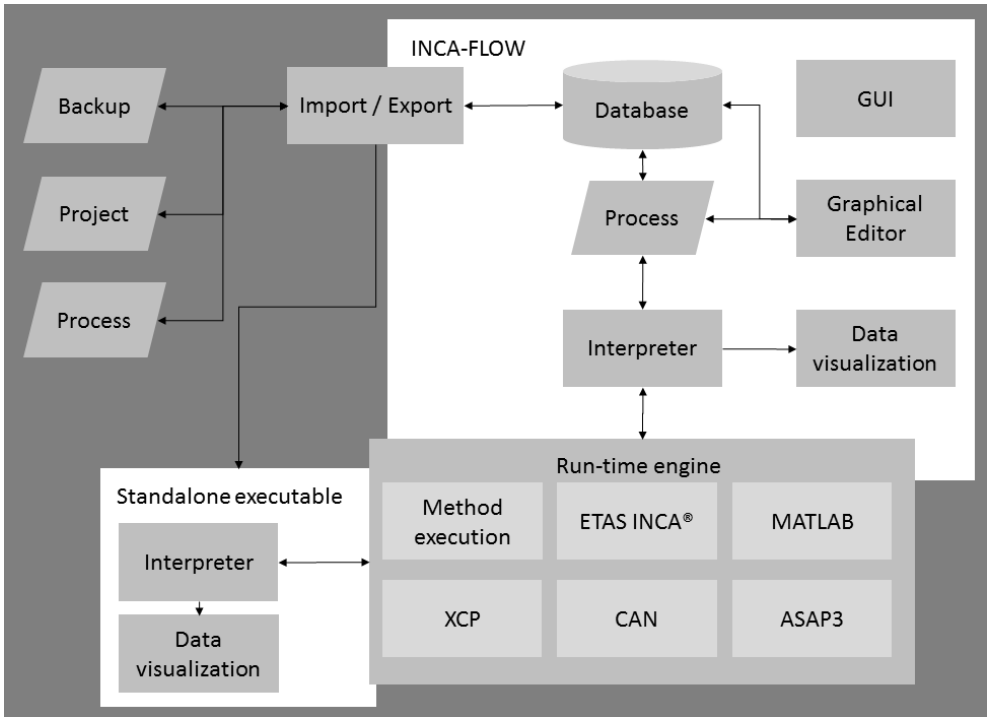

Figure 7: INCA-FLOW data flow

The database holds all A2L-definitions for the user-created calibration processes and further information required by INCA, e.g. database location and the device used. Processes are designed via a graphical editor and saved to the database as well. The interpreter defines the interface to INCA and executes the processes.

3.2 Preparing to Install

Check that all items have been delivered and that your workstation complies with the system and software requirements.

> **NOTE**
>
> Administrator rights are required to install and uninstall INCA-FLOW.

3.3 Installing

This section gives you step-by-step instructions on how to install INCA-FLOW.

The setup will start automatically when you run the INCA-FLOW installation CD. Otherwise, double-click the setup.exe file in Microsoft Windows Explorer. The “welcome” window opens.

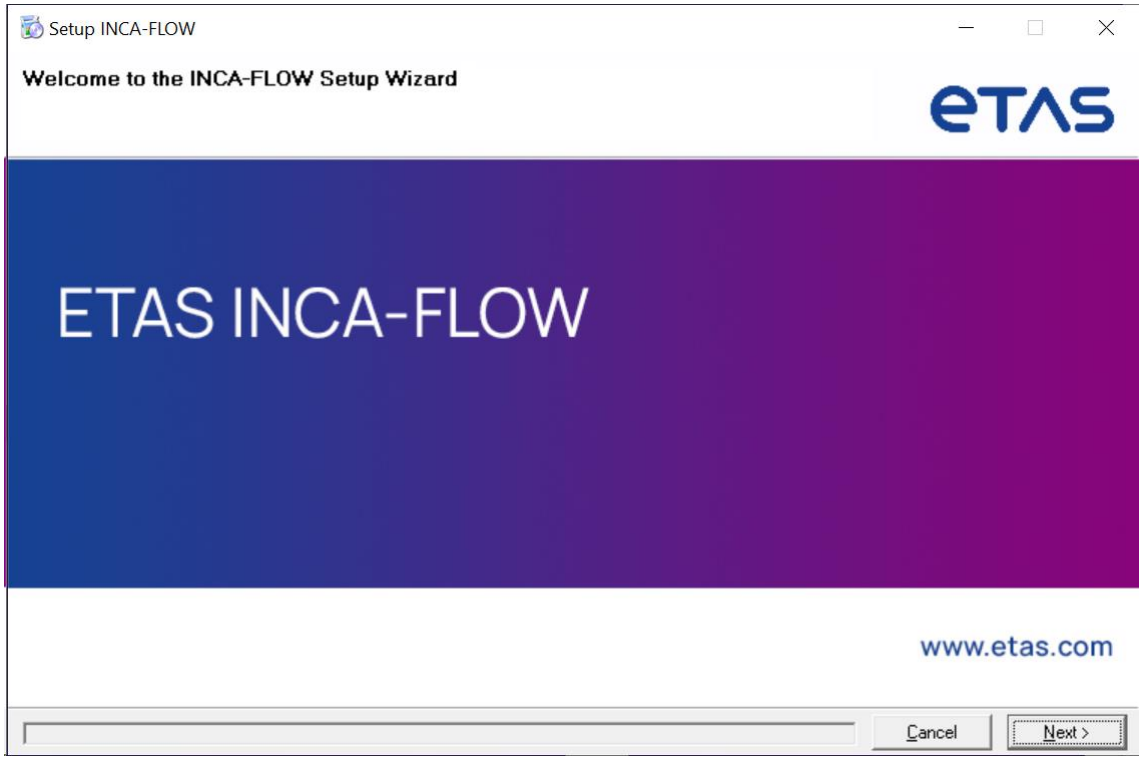

Figure 8: INCA-FLOW Setup

Click **Next** to start the setup wizard.

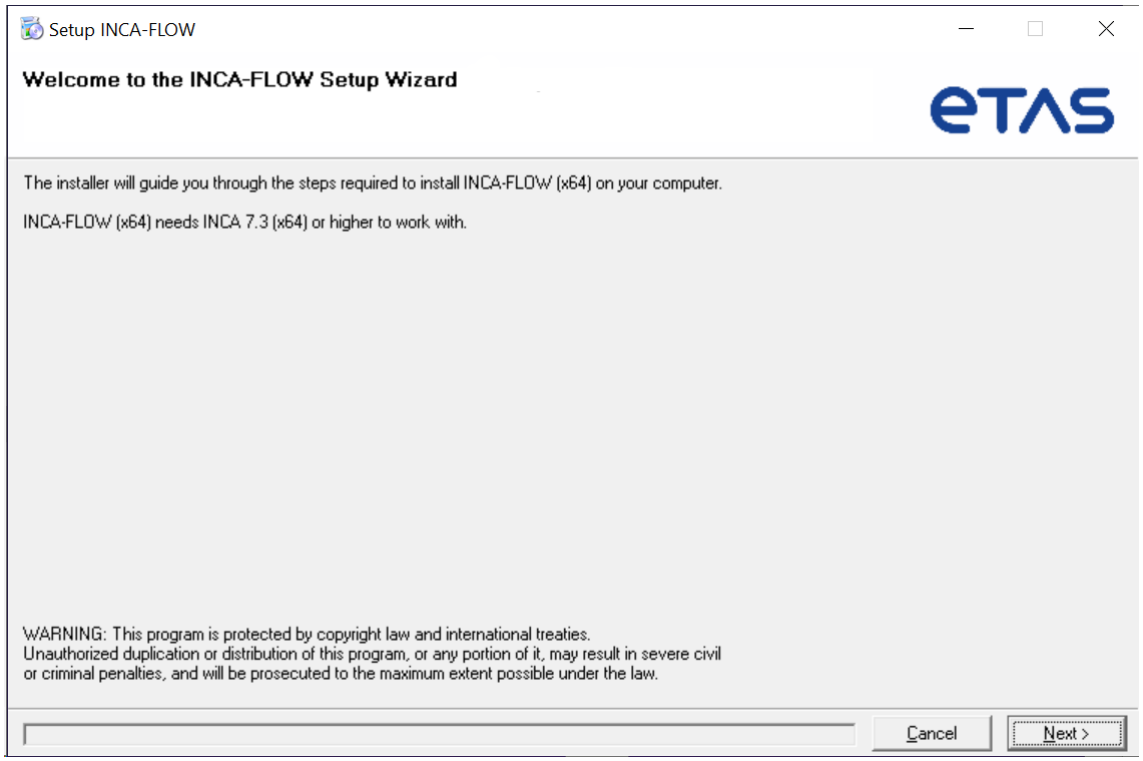

Figure 9: Welcome window

Click **Next** to start installation in the default directory. Or click **Browse** to specify the required paths for installing the software.

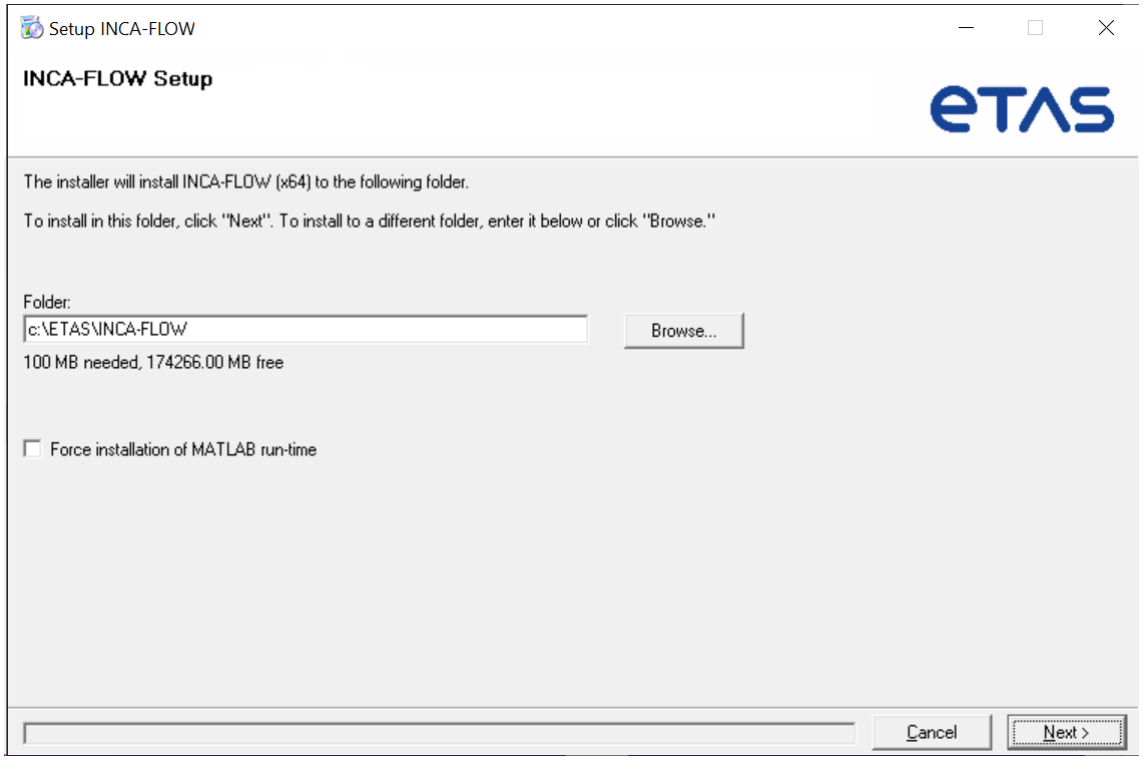

Figure 10: Select installation folders

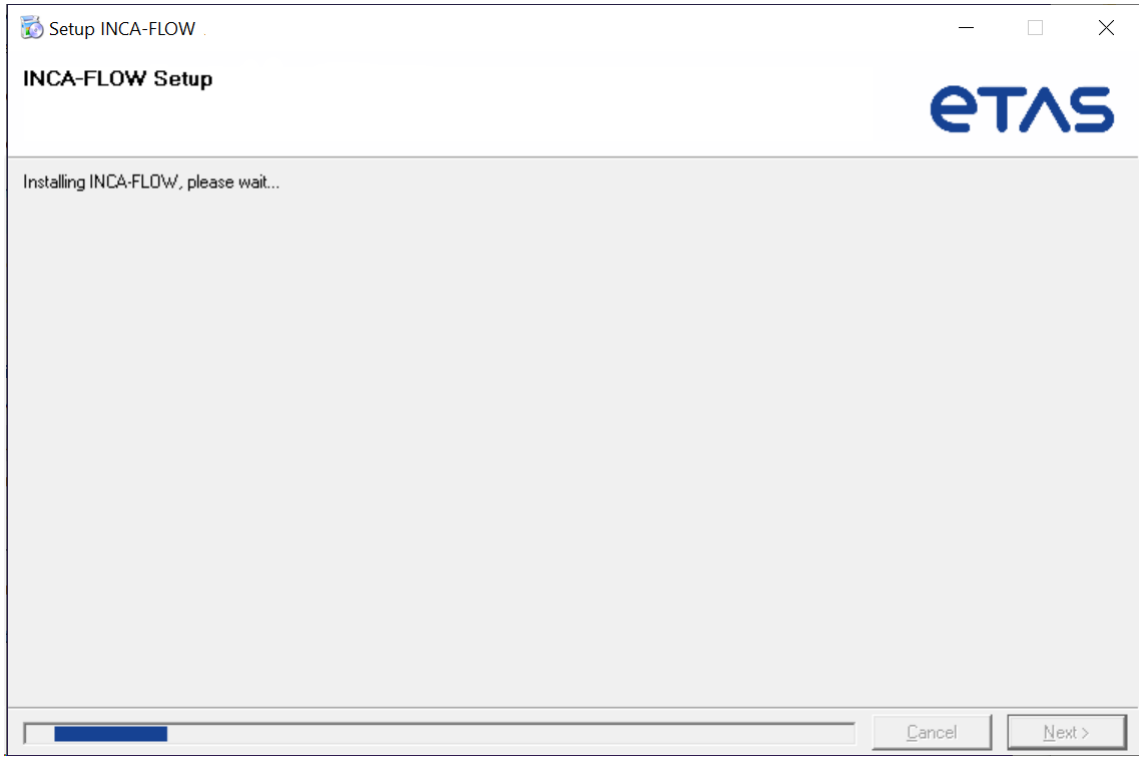

Figure 11: Installing INCA-FLOW

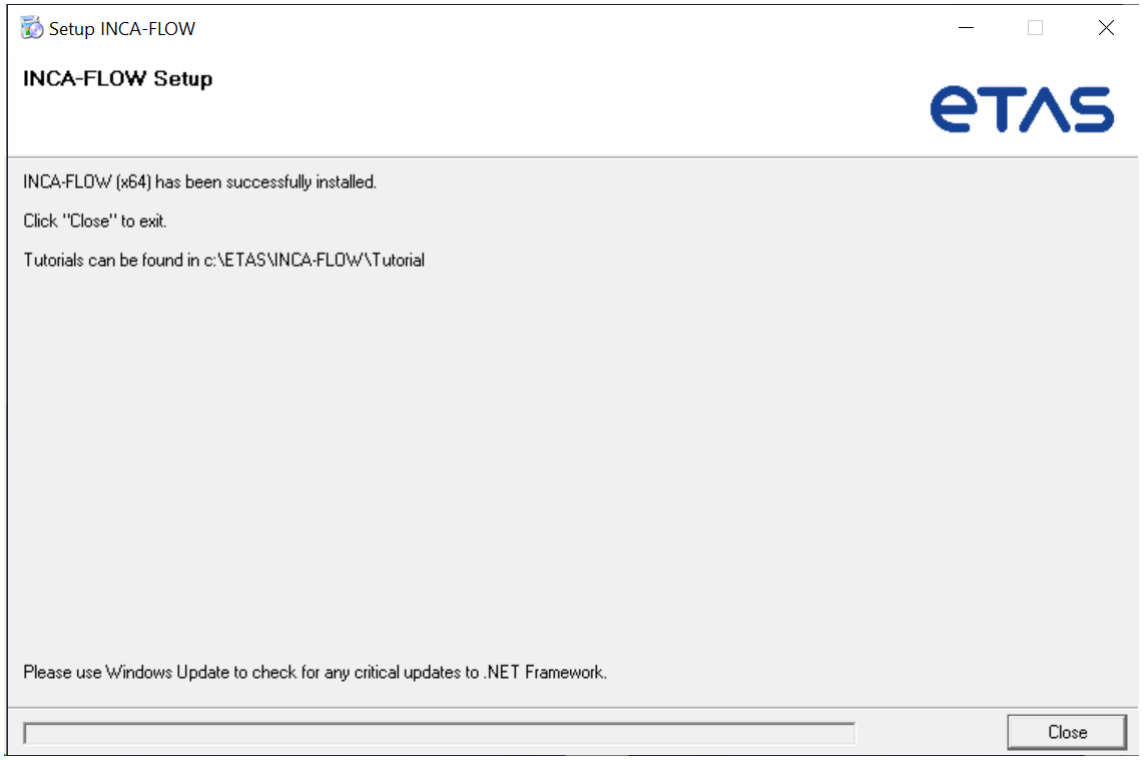

Figure 12: Installation complete

Click **Close** to exit the installer.

3.4 Licensing

A valid license is required for using INCA. You can obtain the license required for licensing from your software coordinator, via the self-service portal on the ETAS Internet Site under https://www.etas.com/support/licensing, or via the ETAS License Manager. To request the license, you must enter the activation ID which you received from ETAS during the ordering process. In the Windows Start menu, select E > ETAS > ETAS License Manager. Follow the instructions given in the dialog. For further information about the ETAS license models or borrowing a license press F1 in the ETAS License Manager.

3.4.1 Check the License Status

This chapter tells you how to check the license status.

In the Windows Start menu, select Programs, ETAS, License Management, ETAS License Manager.

INCA-FLOW has several licenses directly connected to the toolboxes of INCA-FLOW and addressing different use cases for the calibration:

3.4.1.1 Toolbox Basic Methods, Calculation Methods, Library Methods and Structure Elements

Feature: CBASE

This toolbox is part of the standard product and comes with the product. It contains base methods addressing standard calibration procedures to be modelled with INCA-FLOW. It also contains methods for structuring the process design and to encapsulate certain calibration procedures in own library methods.

3.4.1.2 Toolbox Analysis Methods

Feature: CTBTA

This toolbox addresses calibration procedures which are focusing on analysis and evaluation of measurement data from online data stream or measurement files.

3.4.1.3 Toolbox Optimization Methods

Feature: CTBTO

This toolbox has its focus on calibration procedures which help to optimize calibration parameters during the execution of the calibration procedure.

3.4.1.4 Toolbox Design Methods

Feature: CTBTD

Special base methods for calibration procedures focusing on user interactivity and stimulating the system to be calibrated

3.4.1.5 Toolbox MiL Methods

Feature: CTBTM

This toolbox contains base methods which can be used for calibration procedures in a MiL-(Model-in-the-Loop) environment.

3.4.1.6 Toolbox CAN Methods

Feature: CTBTA

This toolbox contains functionality for using CAN messages (receiving and sending) when designing calibration procedures

3.4.1.7 Toolbox Testbench Methods

Feature: CTBTB

The testbench methods toolbox has special base methods for calibration procedures at test benches and also methods which interact with ETAS ASCMO.

3.4.1.8 Toolbox Driveability Methods

Feature: CTBEDT and CTBTDT

This toolbox contains functions for driveability evaluation based on online or offline (measurement) data. The toolbox has two possible different licenses called EDT and TDT. EDT addresses functionality to evaluate the driveability from the engine point of view; TDT addresses functionality to evaluate the driveability from the transmission point of view.

3.4.1.9 INCA-FLOW Runtime License

Feature: CINCA

The INCA-FLOW Compiler (Export SI package) can create stand-alone scripts, which can be executed with INCA.

Such scripts require an INCA-FLOW Runtime license, which needs to be obtained from ETAS and installed with ETAS license manager.

To install the runtime license information on a target PC, run .\RuntimeLicense\RTLicenseSetup.exe from the INCA-FLOW setup location.

3.5 INCA-FLOW Silent Setup

It is possible to install INCA-FLOW with a silent setup. For the silent setup, use command line parameters.

By performing a silent setup you implicitly agree to the INCA-FLOW license.

> NOTE
>
> Close all other applications before you start the silent setup.

3.6 Command Line Parameters

The following command line parameters are possible:

> -q[setupscript] Full silent installation with the parameters from e.g. setup.ini.

> -log [filename] Log file name

> -errordlg {YES|NO} Display dialogs in case of critical installation errors

> -inst [foldername] Target directory for INCA-FLOW installation

The parameters specified in setup.ini can be overridden via command line parameters, see setup.ini.

3.7 Uninstalling INCA-FLOW

This section contains information about uninstalling INCA-FLOW.

> NOTE
>
> Administrator rights are required to uninstall INCA-FLOW.

Follow the steps to uninstalling INCA-FLOW:

1. Open **Apps and Features.**
2. Select the **INCA-FLOW** version.
3. Click **Uninstall.**
4. Click **Yes** to confirm.
5. INCA-FLOW has been uninstalled.

> NOTE
>
> The subfolders ‘logs’ and ‘db’ will not be removed by the uninstaller. All processes will be kept, the SQLite database remains in the ‘db’-folder.

4 Installing the INCA-FLOW Runtime License

The INCA-FLOW Compiler (Export SI package) can create stand-alone scripts, which can be executed with INCA.

Such scripts require an INCA-FLOW Runtime license, which needs to be obtained from ETAS and installed with ETAS license manager (see chapter 6).

To install the runtime license information on a target PC, run .\RuntimeLicense\RTLicenseSetup.exe from the INCA-FLOW setup location.

5 Contact Information

Technical Support

For details of your local sales office as well as your local technical support team and product hotlines, take a look at the website: www.etas.com/hotlines

ETAS Headquarters

ETAS GmbH
Borsigstraße 24
70469 Stuttgart

Phone: +49 711 3423-0
Fax: +49 711 3423-2106