ETAS INCA V7
Performance Tips and Tricks

User Guide

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ETAS INCA V7 Performance Tips and Tricks | User Guide R01 EN | 03.2024

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1 Introduction

INCA supports engineers in the automotive industry to perform their measurement, calibration, validation, and diagnostic tasks. These tasks typically place high performance requirements on a computer system. For example, large description files such as ASAP2 (ASAM MCD-2 MC) are used, enormous amounts of measurement data must be recorded and analysed, and many signals must be monitored and visualized. During the development of INCA, these performance requirements were considered, so that INCA can manage the daily tasks of a calibration engineer on a standard Windows© computer.

However, there are other environmental effects that cannot be influenced by the design and the development of INCA but do affect INCA's performance.

These are:

- The hardware configuration of the computer running INCA.
- The software environment, under which INCA runs, i.e., the operating system and other software applications running in parallel with INCA.
- The individual use and configuration of INCA by the user.

The goal of this document is to provide some best practices and tips and tricks on how to deal with these environmental effects to achieve the best possible performance when running INCA.

NOTE

Since the given tips and tricks are highly dependent on the individual used computer hardware and software environment used, they can only be considered as general hints Therefore, each tip should be evaluated under your actual environment. There may be some tips that bring performance improvements under the used environment and others that do not.

2 Computer Hardware Configuration

As with any software product, the performance of INCA depends strongly on the computer hardware used. This chapter contains recommendations which computer hardware you should choose for running INCA.

2.1 INCA System Requirements

We recommend two generic computer hardware configurations for using INCA:

Minimum System Requirements	Mandatory to run INCA
Recommended System Requirements	Results in an acceptable performance for standard INCA use cases

You can find the current system requirements in the Installation Guide and the Release Notes of your INCA version.

NOTE

The Oscilloscope released in INCA V7.1 requires graphic boards that support DirectX 9.29 or higher and are equipped with sufficient RAM (1GB recommended) on board.

2.2 Individual Computer Hardware Components

The above given recommendations assume that there are no other resource-intensive applications are running in parallel to INCA and that the user works with projects and experiments of medium size[1]. If this is not the case, exceeding the specified system requirements helps to ensure good INCA performance.

NOTE

The performance of a computer system is not only determined by the performance of the individual hardware components, but also depends on their smooth interaction.

Therefore, before defining a standard computer configuration for a department or a company, ETAS recommends evaluating the performance of such a computer.

[1] Example of a medium-sized project and experiment: A project with ~15.000 variables, 2 ECU devices and an experiment with ~10 layers and ~ 500 selected variables.

2.2.1 Processor

The CPU is the computing engine of your computer and therefore has a major impact on the performance of INCA. However, the price/performance ratio for CPUs is not linear, which means that choosing the latest CPU models will result in only a slight increase in performance at a significantly higher price compared to state-of-the-art CPUs.

> **NOTE**
>
> The best practice is to select the second latest CPU core generation, which typically provides a good performance at a reasonable price.

2.2.1.1 Multi-core CPUs:

Starting with version 7.1, INCA supports single and multi-core CPUs. In the case of a multi-core CPU, one core is used for INCA and on the other core can be used to run a target server. The target server is an INCA component that manages the low-level hardware access.

2.2.1.2 Mobile CPUs:

Mobile CPUs are offered for notebooks. They are optimized for low power consumption, which results in longer hours of operation while running on battery power. However, mobile CPUs tend to perform less well than standard CPUs.

> **NOTE**
>
> Mobile CPUs are only recommended if the user frequently runs his notebook in battery mode for long periods of time. For use in vehicles, 12V DC/AC adapters should be considered as an alternative.

2.2.2 Main Memory (RAM)

The main memory of a computer is used to store parts of the running operating system, running applications and their data in use. Compared to a hard disk, the RAM has much faster access times. When the computer runs out of available RAM, the operating system expands the RAM by swapping parts of the data to the hard disk. Due to the slower access times, this swapping has a negative impact on systems performance. Therefore, ETAS recommends that the computer be equipped with sufficient RAM.

2.2.3 Hard Disk / Solid State Disk

You can install INCA either on a hard disk or on a solid-state disk.

2.2.3.1 Hard Disk

The hard disk (HDD) is typically one of the slowest components in a computer and can be a performance bottleneck for the system, especially when using large data files. The performance of a hard disk depends on several factors, such as rotation speed, cache-buffer size, and bus interface. However, consideration of these factors is beyond this document.

All these parameters result in two main key performance indicators:

- *Sustainable Data Rate*
- (Data) *Access Time*

For further information, see the data sheet of the hard disk.

The storage capacity of the hard disk is only limiting the amount of data that can be stored on a device and has no impact on performance. The storage capacity of modern hard disks is more than sufficient for INCA.

> **NOTE**
>
> When selecting a new computer, compare the HDD access times of different offerings. Changing the HDD of an existing computer just for performance reasons makes less sense unless you need more storage capacity anyway.

2.2.3.2 Solid State Disk

The market prices for SSDs (Solid State Disks) have dropped significantly in recent years, making them a viable alternative to HDDs. Internal ETAS comparisons have shown an average performance increase of 10% for INCA compared to a typical HDD. However, the actual possible performance increase depends strongly on the use cases performed under INCA. For example, the first opening of an experiment is 14% faster when using an SSD, but the second opening of the same experiment shows no performance increase due to the caching algorithms of the operating system.

There are no speed differences between SSDs and HDDs when writing measurement files. Both supports the maximum write speed of the ETAS hardware.

The main advantage of the SSD is the fast file access when reading / writing multiple files and when accessing the INCA database.

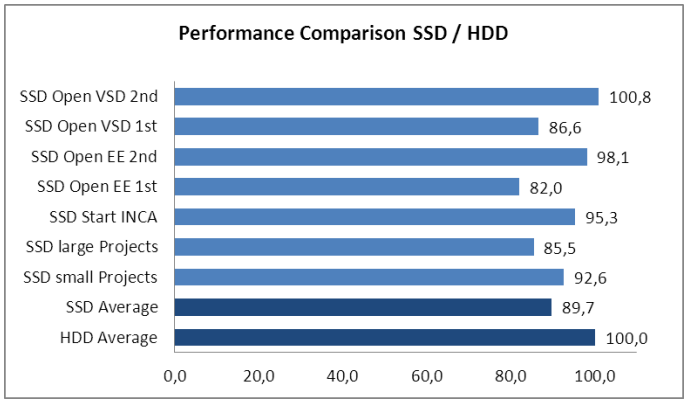

Fig. 2-1 Performance comparison SSD / HDD

2.2.4 Network Adapter

An Ethernet adapter via USB has only a restricted interrupt support. Measuring with high raster speed is not possible.

- Use a native Ethernet adapter

2.3 Corporate LAN

Depending on the services running in your company, e.g., background updates, backups, etc., the performance of INCA may be affected.

NOTE

If possible, use the INCA computer without being connected to the corporate LAN.

3 Software Environment

3.1 Virtual Operating Systems

The use of INCA in a virtual machine (VM) is restricted and not recommended:

- The virtual machine requires sufficient working memory (RAM). Otherwise, the performance of INCA will be reduced.
- Access to sufficient graphics card memory (Direct X) is required. Otherwise, the oscilloscope representation of measurement signals is not possible.
- Access to hardware interfaces, such as Ethernet, USB, etc. is required. Otherwise, INCA cannot use the connected hardware.
- Measurement samples may be lost, and the accuracy of time stamps is not guaranteed, since the higher task priority for hardware access (target server) is not given.

3.2 Energy Saving Mode

To save battery power, some notebooks offer the option of reducing the performance of system components when the notebook is not connected to the AC power supply. This can affect the performance of INCA, for example, if the processor speed is reduced in battery mode. Always switch off any power saving mode for high performance measurements.

NOTE

For maximum performance connect your computer to a power supply or configure the Windows energy saving options in a way that maximum performance is granted even under battery mode.

NOTE

Use presentation mode to prevent your computer from going to sleep or hibernate.

Press WINDOWS+X > select the **Mobility Center** > activate **Turn on** in the Presentation Settings.

This changes the status of the Presentation Settings to Presenting.

3.3 Hard Disk Data Encryption

For data security reasons, modern computers provide an automated encryption of data stored on the HDD. This encryption forces the system to encrypt / decrypt any data access to/from the hard disk drive, which has a negative impact on system performance. The amount of the performance decrease depends on the computer hardware / BIOS configuration used.

> **NOTE**
>
> In case of unexpectedly low system performance, ETAS recommends that you investigate the impact of the hard disk encryption under the computer hardware /BIOS configuration in use. If the encryption is found to be the root cause, use a hard disk password instead of hard disk encryption. However, since this could lead to less data security, discuss this step with your company's IT department.

3.4 Virtual or Shared Drives

The performance of virtual or shared drives can have an impact on the INCA performance.

INCA regularly writes data to the INCA database, e.g., during calibration. Depending on the drive performance, the drive where the INCA database is stored may not be accessible fast enough.

If the drive where the INCA database is stored has a higher latency for read or write access, this directly affects the INCA performance. This can happen if any other processes are synchronizing shared drives in the background.

> **NOTE**
>
> To optimize the INCA performance, use drives that are connected to the INCA computer with high bandwidth and low latency.

3.5 Applications Running in Parallel

Running other applications in parallel to INCA means that these applications must share the system resources (RAM, CPU) with INCA. Depending on the applications used and the computer configuration, this can have a significant impact on the performance of INCA. You can easily evaluate this effect by monitoring the system resources in the Windows© Task Manager.

To work reliably with high performance measurements, ETAS recommends the following actions:

- Set your energy saving plan to the highest possible performance
- Partially disable your virus scanner:
  - Offline scan of your HDD
  - Scan on your network card
- Activate only necessary network clients and services or protocols
- Update your network card driver

NOTE

If you experience a decrease in performance due to applications running in parallel with INCA, you have the following options:

1. Reduce the number of applications running in parallel.
2. If this is not possible, consider increasing the overall system performance by upgrading the computer hardware configuration or individual hardware components (see chapter *Individual computer Hardware Components* on page 5).

3.6 Virus Scanners

Virus scanners can have a significant impact on the system performance. They typically provide three different scanning modes:

- Manual scanning of files, folders, or entire partitions
- Scheduled scanning of files, folders, or entire partitions
- Online scanning

While in the first two modes, the scanning is performed only when triggered by the user or at a predefined time. In the third mode every file immediately gets scanned when accessed by the system.

Since INCA accesses many files while running, the impact of online scanning on the performance of INCA can be significant.

NOTE

To avoid negative effects on the performance of INCA do the following:

- Perform manual and scheduled scans at times when you are not using INCA (e.g., during lunch break)
- Exclude the file paths of INCA from the online scans:
  - C:\Program Files\ETAS *
  - C:\ETAS *
  - D:\ETASData *

* The exact path may vary on your computer. You can configure during installation.

3.7 Multimedia Timer

MS Windows uses the multimedia timer when an application plays videos or other multimedia services. The multimedia timer can have a negative impact on the network communications:

– Disable the multimedia timer in the registry.

Select the path 'Computer\HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Multimedia\SystemProfile' and set the key 'NetworkThrottlingIndex' to '0xFFFFFFFF'.

> **NOTE**
>
> To disable the multimedia service is not sufficient.

3.8 Instant Messaging Services

Instant messaging services require a certain amount of network bandwidth. This conflicts with high performance measurements.

– Do not install or use instant messaging services while INCA is running.

> **NOTE**
>
> No user should be logged into Skype, Jitsi, Zoom, or any other instant messaging service.

4 Operation Hints for INCA

In addition to the computer hardware configuration and additional applications running in parallel, the way of handling INCA and project files can have an impact on its performance.

4.1 Data Access from the Corporate Network

File access to network shares is in most cases significantly slower than the access to local hard drives. Therefore, frequently accessed files should be stored on the local computer.

NOTE

- Make sure that the INCA database is located on the local hard disk.
- Copy project files that are frequently accessed by INCA to the local hard disk.

If necessary, configuration management tools (e.g., SubVersion) can help to keep the original project files on the network share and the local copies on the local hard disk consistent.

4.2 ASAP2 Files

Due to the increasing number of measurement and calibration variables in a project, the size of ASAM MCD 2MC (ASAP2) files has increased significantly in recent years. Therefore, reading and parsing these files in INCA becomes increasingly time-consuming. However, there are some ASAP2 elements that are more critical for the parsing performance than others.

For further information, see the following sections.

4.2.1 COMPU_METHOD "FORM"

In an ASAP2 file the conversion formulas “COMPU_METHOD” can be defined by using the following types:

- IDENTICAL
- FORM
- LINEAR
- RAT_FUNCTION

While INCA can calculate the formulas of the types IDENTICAL, LINEAR and RAT_FUNCTION online during operation, it must convert the type of FORM into a lookup table when parsing the ASAP2 file. This is a time-consuming and memory consuming task.

NOTE

Avoid COMPU_METHODS of the type "FORM" in your ASAP2 files. They can often be replaced with the RAT_FUNCTION type.

4.2.2 Errors and Warnings

If INCA detects ASAP2 constructions that lead to errors or warnings in INCA, a time-consuming handling is necessary.

> **NOTE**
>
> Update and correct the A2L description file causing the errors and warnings.

4.3 ASAP3 Latency / Bandwidth

Optimizing the data transfer between the automation system and INCA means finding the best compromise between bandwidth and latency. For this purpose, INCA offers a user option for tuning the measurement data transmission from maximum bandwidth to minimum latency.

> **NOTE**
>
> Use the INCA user option “Experiment / Measure / General / Cycle time for measure data polling [ms]” to tune the measurement data transmission from INCA to the automation system. Use 100ms for maximum bandwidth and 10ms for minimum latency.

4.4 Opening the Experiment Environment in Offline Mode

If you open the Experiment Environment, INCA automatically searches for connected hardware and initializes it. However, there are uses cases where you only want to access the Experiment Environment without any hardware access. For example, you may want to prepare an experiment at your desk for later use in the vehicle.

For such cases, you can open the Experiment Environment in an offline mode and skip the hardware search and the hardware initialization.

> **NOTE**
>
> To switch between online and offline access to the Experiment Environment, click on the Experiment icon in the toolbar of the INCA Database Manager:
>
> -  Experiments open in online mode
> -  Experiments open in offline mode
>
> Even if the Experiment Environment is opened in offline mode, you can explicitly switch to online mode by pressing F3 (initialize hardware).

4.5 Dynamic Loading of Experiments

INCA V7.1 and higher load experiments dynamically. This means that when the experiment is opened, not all layers of an experiment are loaded, but only the active layer. Whenever the user switches between layers, INCA unloads the components of the current layer and loads the components of the layer selected by the user. This dynamic loading/unloading of layers results in a reduced consumption of Windows resources (memory, GDI resources) and a faster initial opening time of the experiment. However, the dynamic loading of layers also results in a short delay when switching between layers. If a layer contains many elements, this delay would be noticeable to the user. To avoid this, INCA does not unload layers with many elements after they have been loaded. This minimizes the delay when activating this layer, but results in a slightly higher consumption of Windows resources.

NOTE

When working with large experiments, you can reduce the required Windows resources (memory, GDI resources) by distributing layers with many elements to several smaller layers.

4.6 Preconfiguring Experiment Environment Instruments

All measurement and calibration instruments newly added to the Experiment Environment are opened with a predefined style (background color, font color, font size, ….). Later, the style of each instrument can be changed individually in the “Properties” dialog ALT+RETURN of the instrument or in the “Display Configuration” Window F4 of the Experiment Environment.

You can save configuration time by adopting the predefined style of each instrument type in the INCA User Options to your preferred settings (e.g., the default background color of oscilloscopes).

NOTE

Use the INCA user options below “Experiment / Measure” and “Experiment / Calibration” to tune the default settings of Experiment instruments to your personal preferences.

4.7 Number of Variables in the Experiment

The Microsoft Windows operating system uses so-called GDI objects to display GUI elements. Microsoft limits the number of GDI objects that can be used by a single application to ~10'000 objects. To minimize the system load, most signals should only be recorded. Only visualize those signals, which are necessary for live analysis. Each GUI element in INCA requires a certain number of these GDI objects. When using experiments with many instruments, INCA may run out of GDI objects. In this case, INCA displays a warning, and it will not be possible to add more instruments to the experiment.

You can increase the number of measurement and calibration variables that can be displayed in an experiment by using the "Measurement Table" and "Calibration

Table" instrument types instead of the "Measurement Windows" and "Calibration Windows" instrument types, since the tables require fewer GDI objects than the classic windows.

> **NOTE**
>
> It is possible to increase the maximum number of GDI objects that a single application can use by editing the operating system registry. However, this can lead to unexpected system crashes when the total number of GDI objects for all applications is used up.
>
> Therefore, ETAS does not recommend increasing the maximum number of GDI objects in the operating system registry.

4.8 Borrowing INCA Licenses

INCA supports three different types of software licenses:

License Type	Storage	Information
Machine-based	local	The license is valid only on a specific computer and linked to hardware specific IDs (e.g., MAC address of the Ethernet adapter).
User-named	server-based	The license is linked to the MAC address of the server and to the username with which the user is registered in the network.
Floating	server-based	Several users share a limited number of licenses

While the license file for machine-based licenses is stored locally on the computer, the license file for the other two license types is stored on a license server in the company network. When starting INCA, the validity of the license is checked. Since network access takes longer than access to a locally stored license files, the validation of user-named and floating licenses takes somewhat longer than the validation of a machine-based license.

Delays in licence validation can also occur when the auto-borrow mechanism is used. When installing INCA, you can specify that the software license is automatically borrowed from the server for a predefined period ("*BorrowExpiryInterval*"). Furthermore, you can define how many days before the expiration date the borrowing of the licenses should be renewed ("*ExecuteBorrowAutomaticExtensionInterval* "). If these two periods are almost the same, license borrowing is often performed without any need. Especially after holiday periods, e.g., Christmas, this can lead to a high borrowing activity on the license server and thus to significant delays, as the INCA installations of all users will re-borrow their license on the first working day.

> **NOTE**
>
> For more details on how to configure the auto borrow mechanism, refer to the ETAS License Manager online help.

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

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Definitions and Abbreviations

AuSy

Automation System

CPU

Central Processing Unit of a computer, shortly processor.

GDI

Graphical Device Interface

GUI

Graphical User Interface

HDD

Hard Disk Device

OS

Operating System. In this document only Windows© operating systems are considered.

SSD

Solid State Disk

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