Car similar user-interface,
for simulation models in CANoe

Bror-Erik Svensson
Tobias Westermark

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University of Trollhättan/Uddevalla
Department of Technology
Box 957, S-461 29 Trollhättan, SWEDEN
Phone: +46 520 47 50 00 Fax: +46 520 47 50 99
E-mail: teknik@htu.se
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Summary

There are many ways to make development-methods more efficient. Elaboration of test-methods is one way.

This dissertation-project intention was to make an ergonomic and clear user-interface to the analyse-tool CANoe. The dissertation-report describes how the interface-panel was styled and the problems that occurred during the dissertation-project.

It did not take long time to style the interface-panel for CANoe. Therefore the dissertation-project was extended. In order to use the panel for real testing, verification and validation were made. The interface-panel depends on CAN-bus signals, stated in RNA-models, and is therefore vulnerable to model changes. As long as the signals names are not changed the interface-panel is not affected.

During the dissertation an instrument-panel were styled as well.

Keywords:

CANoe
Ergonomic
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RNA
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Publisher: University of Trollhättan/Uddevalla, Department of Technology
Box 957, S-461 29 Trollhättan, SWEDEN
Phone: + 46 520 47 50 00  Fax: + 46 520 47 50 99  E-mail: teknik@htu.se

Author: Bror-Erik Svensson
Tobias Westermark

Examiner: Per-Olof Andersson
Advisor: Niclas Lindmark, SAAB Automobile AB

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Preface

Along with the technology evolution, development methods are also elaborated to improve the advances and to lead onto new fields and technologies.

When Saab Automobile developed the Saab 9-3 Sport Sedan they enhanced their development method. Earlier Saab made system-specifications and some function-specifications. With the new development-method Saab made all function-specifications, which gave them a better opportunity to develop with fewer flaws. This made it easier for both Saab, as well as the supplier, to obtain a good quality early in the development process. The supplier could more easily understand Saab’s intentions, and Saab could easier correct a supplier who delivered incorrect products.

In this new development-method all electric components were to be tested, separately and together in test-rigs (an integration-test), before any car were to be build. Earlier the supplier delivered products and Saab tested them only separately before they were installed in vehicles. Components could be sent between Saab and the suppliers several times before construction. The integration-tests gave more qualitative products and shorter development-time.

For next-coming car-development, Saab has begun elaborating their present method. In order to reduce the development-time, Saab is working on the lead-time cutting process named 3FD (Fast Formal Function Development). The purpose of the method is to transform functional requirements (flow-charts, state diagrams et cetera) into executable code (RNA-models (RNA – Reusable Node Architecture)) with little effort and with the same structure for all functions; the executable code can then be implemented into the electric components.

The biggest change with the 3FD-method is that Saab can simulate the functional demands before any prototype is developed. In this way any faults can be found before any supplier is contacted and there will be less unpleasant surprises during the development.
Figure 2 shows the 3FD-methods development-steps. It can seem like the incensement of steps, compared with present amount of steps ought to increase the development-time; but it is the contrary. Since simulation can be done before any products are built, faults (what often occurs in development-testing loop) can be prevented.

![Figure 2 – Future development steps](image)

Earlier Saab’s suppliers did this work, from specifications to code and implementing the code into the electric components before delivery. That method is time-consuming and changes are not corrected before next regular delivery (in best cases, often not before 2:nd or 3:rd regular delivery).

With the 3FD-method, Saab can control the development in three ways:

1. The supplier obtains a behaviour-model, as a reference to the specifications. All other development is made as before.
2. The supplier obtains Statemate-models (view appendix A) from Saab and generates RNA-models. The RNA-models are implemented in the components before delivery,
3. Suppliers only produce the hardware; Saab develops all software, from specification to implementation of models.

![Figure 3 – Development phases and duty sharing (Lillskog, Ulf, 2002)](image)
One advantage with the RNA-models is that the hardware can easily be exchanged for cost-reduction. Changes to make the RNA-models fit to new hardware simply requires recompiling. The software does not have any hardware dependencies. As long as the interface between the models and the hardware are the same, no software-changes are necessary.

A more detailed description on the 3FD-method is described in appendix A.

In order to make the simulation and testing more efficient, this dissertation-project were made.

The dissertation-project was focused on ways to improve the simulation and testing by graphical enhancements.

We would like to thank all people that have helped us during this dissertation. Niclas Lindmark at Saab Automobile AB for his enthusiasm and support. Thomas Lindgren in the Department of Ergonomic at Saab Automobile AB for his help on how to create clear and ergonomic panels. Function-owners and test-engineers on the TLD department for evaluating the panel design. Ivan Wilson for all his help with the 3FD-method and all other Saab employees that has helped us during the dissertation. Kristin Ronlind for her help with corrections of the dissertation-report. We would also like to thank Joachim Fritzson at Kvaser AB for the opportunity to evaluate Kvaser’s new CAN-bus development-tool Creator.

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Trollhättan 29 January 2003
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Acronyms and abbreviations

3FD: Fast Formal Function Development – a Saab Automobile AB specific development technique

API: Application Program Interface - used to access the functions obtained by the operating system.

CAN: Car Access Network – a protocol aimed at networks in cars

CAPL: Can Access Programming Language – Vector’s own programming language for the CAN family (CANoe, CANalyzer et cetera)

Distributed network: A network where the computing ability is physically decentralized to several computing units

dll-file: Dynamic Link Library file – contain software-functionality.

Drivert-block: Driver / Convert block – convert signals between RNA-logic and the physical protocol used

Environment-variable: Local variable in CANoe

GCL: Generic Communication Layer – obtain communication for the software

GM: General Motors – car manufacturer

GMLan: General Motors Local Area Network – GM’s CAN-bus protocol standard

MOST Media Oriented Systems Transport – High-speed bus used for media contents in Saab 9-3 Sport Sedan

Node: A computing unit in a distributed network

OSEK: Offene Systeme und deren Schnittstellen für die Elektronik im Kraftfahrzeug (Operating System Standard for Automotive Electronic) – a small operating system adapted for use in car electronics

RNA: Reusable Node Architecture – a software model that easily can be adapted to different hardware. The result from the 3FD-process
1 Introduction

This chapter presents the objective and reasons for this bachelor dissertation.

1.1 Background

The software CANoe is an analytical-tool for evaluation of CAN (Car Access Network) bus communication. The Interface between CANoe and the human user is often poorly designed.

The test-engineers have very different knowledge in how to operate the program. Several engineers are highly skilled in the program whereas other engineers, that seldom use CANoe, aren’t that familiar with the capabilities of the program. Saab’s intention is to make evaluation more efficient, without having to learn the program every time the program is used.

One way to make evaluation easier is to make an interface that is easy to understand and to use. To make the interface easy to understand, it has to be ergonomic and plain.

1.2 The objective

The main objective of the dissertation was to create an ergonomic user-interface for CANoe, based on the Anti Theft and Power Lock functions. The project also embraces further studies regarding the use of the panel, general development methods and software involved.
The dissertation-project is focused on the use of CANoe, by means of making the 3FD-method more efficient.

The objective with this dissertation-report is to describe what has been done during the dissertation-project and to document experiences, both positive and negative.

1.3 Demarcations

In order to accomplish the dissertation-project, following demarcations were established:

- Internal signals, not transmitted on the CAN-bus,
- Functions united with other communication-buses,
- No hardware modifications
- No modelling,
- No functions for market differences,

The demarcations for this dissertation-report are:

- No instructions on car-electric systems
- Briefly describe the basics with the 3FD-method

1.4 Device list

In order to accomplish this dissertation following equipment was used:

Software
- MS Word 2000 V9.0.4402 SR-1,
- Paint Shop Pro V7.00,
- MS Paint V5.0,
- CANoe V3.0,
- Virtual CAN V2.6b, (released with CANoe 3.2 option MOST),
- OSEK 2.00,
- Creator 2.0 Beta,
- MS Visio 2000 SR1 (6.0.2072)

Hardware
- Compaq Armada 7800,
- 3FD test-rig; TLD department at Saab Automobile AB,
- LAPcan PCMCIA 2.0/2.1 (CANoe),
- LAPcan PCMCIA SRN: 1662347 (Creator)
1.5 Procedures

In order to obtain a good result, it was decided that the list stated below should be carried out during the preliminary study and the realization phase:

1. Study Software
2. Briefly overview the car electric-system
3. Learn how to style the panel
4. Determine what documents are needed and where to find them
5. Make a preliminary sketch
6. Obtain feedback from the sketch
7. Style the panel and implement feedback
8. Show the panel to the people involved
9. Correct possible faults
2 Preliminary study

Before any tasks are executed, a preliminary study ought to be done, in order to structure the dissertation-project and facilitate the realization phase and obtain better results.

2.1 The car electric-system

To work efficient and without hardship, the functions and main-parts of the car electric-system were studied.

2.2 Software and tools

To use the software and tools in general, they had to be installed and investigated properly before any actual work is taken place.

2.2.1 Installation and study of CANoe

To create a panel the software CANoe needed to be installed. Version 3.0 was installed at first. To use the latest software, containing the most features, the latest version 3.2 was installed instead. In order to get the version 3.2 to compile the CAPL-models (CAPL – Can Access Programming Language), the CAPL-compiler had to be replaced (from version dated 2000_05 to version dated 2000_09).

The version 3.2 installed had “option MOST” (MOST – Media Oriented Systems Transport) and proved to require additional analysing hardware to be present in order to execute. The hardware was hard to obtain. No other CANoe 3.2 version could be found, so CANoe 3.0 was re-installed instead. CANoe 3.0 did not contain any expansions, as “option MOST”, and was therefore more suitable to the project.

As a CAN-card was required to run CANoe, CANoe was installed on a Laptop computer, since it contained a PC-Card slot.

It soon became clear that it was a shortage of CAN-cards. Having to borrow and return CAN-cards interrupted the work and had to be solved. The CANoe-manual described only briefly that it existed something called Virtual CAN that could be used instead of the CAN-card. This, however, only when not interfacing any hardware.

Since only pure simulation would take place in the first stage, this was not considered as a problem. The Virtual CAN proved to be device-drivers, included in the 3.2 version of CANoe. They were installed and worked properly with CANoe 3.0 as well. The instruction for configuring Virtual CAN was insufficient. In order to use the device-drivers instead of CAN-card, the Virtual CAN must be manually configured to CANoe.
A new instruction-manual was written in order to avoid these hardships in the future, view appendix B.

When CANoe and Virtual CAN had been properly installed and configured, CANoe was carefully investigated to understand how the program worked and how to operate it.

### 2.2.2 Software models

In order to use the panel a software model had to be obtained. The first models reviewed contained CAPL-code, written directly in CANoe. After some investigation it was concluded that the CALP-models did not contain any functionality. The only intentions with the models were to generate traffic on the bus. New type of models had to be found.

The first intention was to make general interface-panels for car testing. As the CAPL-models did not contain any functionality, the intention was changed. The dissertation-project was now aimed on making an interface-panel for the 3FD-method, in order to improve it.

The RNA-models proved to fulfil the demands as they contained real node-code, and would therefore be suitable for the project. The RNA-models are a result from the 3FD-process, and to understand the RNA-models, the 3FD-method was briefly overviewed.

However, the RNA-models proved to be in a non-executable state when they were received. They only contained C-code. In order to use the RNA-models in CANoe, they had to be compiled. The code was written in Microsoft Visual C++ 6.0. Therefore the same software was installed and the code could be compiled. The results were several dll-files (dll – Dynamic Link Library), a dll-file for each simulated node.

But the simulation could not be executed even when the executable files were added to CANoe. The problem was that the operating system itself, OSEK (Offene Systeme und deren Schnittstellen für die Elektronik im Kraftfahrzeug (Operating System Standard for Automotive Electronic)), was missing. When the OSEK-core had been installed, the simulation was successfully executed.

### 2.2.3 Image-editors

To edit the pictures that should be included in the panel, an image editor, Paint Shop Pro, was obtained. Paint Shop Pro is the standard image-editing software at Saab, so it appeared that it should not cause any problems. MS Paint was used in some cases.

### 2.3 Ergonomics

When a user-interface like this panel is styled, it is important to understand the foundation of ergonomics, and how the panel will be used.
The Division of Ergonomics was inquired in an early stage in order to obtain information how to create an ergonomic and easy to use panel.

In order to get the correct functions, for Power Lock and Antitheft, several internal Saab documents were viewed and some Saab employees were inquired. All functions regarding Lock and Antitheft were then listed and grouped according to function.

A sketch was made, based on the information collected from the Division of Ergonomics. The main idea was to keep output in the middle of the panel, and around the output group function (i.e. objects) according to function and location. Strong colours were avoided and objects, with different meaning, having similar appearance.

For more information about how to style an ergonomic and plain interface-panel, view appendix B.

The evaluation-engineers and the Division of Ergonomics reviewed the sketch, in order to get feedback.

The sketch and recommendations were compared with literature regarding HMI (Human Machine Interface). The literature confirmed the recommendations and the sketch were considered to be finished and useful as a foundation for the real panel.
2.4 Problems during the preliminary study

This chapter reports the problems that occurred during the dissertation-project, and solutions to the problems.

2.4.1 Licenses

The license for CANoe is the actual CAN-card. Due to costs, Saab only has a limited amount of cards. This caused a shortage of CAN-cards.

The shortage of cards caused troubles in the initial stage. The software CANoe itself could be installed without any CAN-card, but in order to start it the first time it was necessary to have a card installed. It appeared that a CAN-card had to be used during simulations, and they were borrowed during this period. This procedure disturbed the work in progress, as the CAN-card had to be returned to the owners with short notice.

Installing Virtual CAN device-drivers solved the problem of simulating without CAN-cards, view chapter 2.4.3.

2.4.2 CANoe versions

It was impossible to open the original interface-panel in CANoe 3.0. The version of the project-file itself proved to be too new. When changing to CANoe 3.2 the only version available was with “option MOST”, used for testing the MOST-bus. CANoe 3.2 “option MOST” did not work, since MOST-hardware must be connected during run-time.

The problem was solved by open the original interface-panel in another computer with a newer CANoe-version, and save it as version 2.6. After that the project could be opened in CANoe 3.0.

2.4.3 Adapting Virtual CAN

CANoe demands the presence of hardware at first execution. When sifting the CANoe-manual, virtual channels were found. In search for more information on how virtual channels work and are installed Vector was contacted. Vector’s Swedish retailer Vecscan could not supply any information on virtual channels. The group members investigated software installation guides and solved the problem.

After several re-installations of CANoe, hardware and device-drivers; virtual CAN-channels were successfully installed. Different program-versions were tried out. CANoe v3.0 with Virtual CAN V2.6b proved to be functioning.

An instruction-manual was written, view chapter 2.4.6.
In order to simulate a car electric-system, the GMLan (General Motors Local Area Network) models were obtained. It was discovered that these models did not contain any functionality. They only generate messages automatically to send/receive bus-traffic. These models were not suitable for the dissertation-project and other models (RNA-models) with functionality were used instead.

The hardships regarding the installation of CANoe could have been avoided if the installation-instructions had been more accurate. There was some information missing in the installation-instructions for the program. A new software installation-guide was written, applicable to CANoe for Saab’s current operating system and CANoe version, view appendix B.

The problems occurring in chapter 2.4.1 could have been avoided if the CANoe-manual had been accurate. The manual only mentioned Virtual CAN, but did not instruct how to install it, or where it could be obtained. A new software installation guide was written, applicable to CANoe for Saab’s current operating system and CANoe version, view appendix B.

In order to increase the speed of the realization phase, the plan was to install CANoe on another computer (a office workstation), as well. In order to install CANoe, a PC-card reader for CAN-cards was installed. CANoe card is necessary to execute CANoe for the first time, view chapter 2.4.1.

The PC-card reader that was installed proved after a while to be damaged. The installation went well, the computer managed to locate the card and secured contact with it. But the CANoe-software could not locate the CAN-card. It turned out that some contact-pins were bent and had probably damaged the circuits, on the board, by a shortcut.

The intention to use the office workstation for this purpose was cancelled.

Users are more or less limited when installing software. In networks like the one on Saab, only administrators are permitted to perform certain tasks, such as installing software. This is to prevent users from change critical settings or install harmful
software. To install software in a computer, the network administrator or the Division of Data-support must assist.

Only temporary administrator authorisations could be obtained. The installation of PC-card reader (view chapter 2.4.7) could have been easier if the group had administrator authority at all time.
3 Realization of the main objective

Taking all paragraphs in appendix B in consideration, the final panel was styled as described in this chapter.

3.1 User-influence

The most important task was to integrate the users opinions into the result. The goal was to make the design as obvious as possible, allowing the users to directly solve the specific problem, with assistance from the software. They were asked if they understood everything on screen and how to use the panel. If the user asked something, even a small detail, the design was not clear enough on that point.

3.2 Disposition

The main idea with the disposition used is that the response/output is located in the centre of the panel, as two views of the vehicle. The output-area is surrounded by several input-fields; i.e. interior-controls, sensor activation and the remote. Everything that does not correspond to a button-type of control in reality is located at the top and bottom of the display.

Figure 6 shows the difference between the old panel’s button location and the new panel’s button location.

![Figure 6 – Differences between new and old remote](image-url)
3.3 **Response**

The graphical button-reaction is the only response that is depending on the panel. Every behavioural response is purely depending on the underlying models.

![Button-reaction](image)

Figure 7 – Button-reaction when button is pressed

3.4 **Unpredicted behaviour**

The panel contains no automatic execution in order to simplify the daily use. Instead the intention was to let the user control all events and only demonstrate the model. Adding non-user-driven events would probably just caused a user that’s being confused.

It cannot be determined how the panel will be used in the future. Implement such behaviour can be done first when users come across common tasks that could be simplified, by adding automatic behaviour.
3.5 Handle disabled functions

In the particular case, some functions (i.e. signals) were missing in the software-model, causing some objects to be unnecessary in the panel. Only removing those objects would probably confused the user, who probably would wonder where the expected objects are.

A better solution is to include them, but show that they are disabled.

To show that some objects were disabled (in this case a button) red lines were added across the button.

Figure 8 – Disabled function (panic button)

3.6 Merging of colour and images

To obtain an overall clarity, ordinary photographs were avoided; they contain too much, needless information and would only degree the usability.

To make the panel clear, illustrations from the manual were used instead. They are made with clarity in mind and were therefore suitable this project.

Figure 9 – New and old Ignition key symbol
Different types of buttons were used. The remote and compartment switches were reproduced as close to reality as possible in order to make the meaning of each button obvious to the user, who in most cases is familiar with the appearance of the real car.

The sensor activation buttons on the other hand don’t exist in reality, so they were visualized by standard windows-buttons.

![Sensor-trig buttons](image)

**Figure 10 – Sensor-trig buttons**

### 3.7 Designing symbols

To avoid misinterpretation, the symbols were carefully designed to be as clear and obvious to the user as possible, e.g. padlocks can change both appearance and colour.

![Lock-Status](image)

**Figure 11 – New and old indication of lock-status**

Some symbols could be re-used from the old panel, like the old fashion horn flashing red and indicates that the alarm has been activated. Since no questions about those symbols arose during the development-phase, no extra information in text-format was added to the symbol, for explanation.
3.8 **Animated pictures**

To show the exterior functions, animated bitmap pictures were used. When clicking on a door, it opens in order to give response and visualise the function to the user. The same method was used on the remote-buttons (view chapter 3.3), as well as the hood, trunk and top.

![Example of animated pictures of trunk](image)

**Figure 12 – Example of animated pictures of trunk**

3.9 **Framing**

Thin lines were added to reinforce the impression of different sections in the panel. Each section was framed so that the user immediately can leave out whole sections when searching for a specific function. The framing also makes the view less cluttered.

![Visualizing framing](image)

**Figure 13 – Visualizing framing**

3.10 **Interface-menu**

It was not necessary to add a menu to the panel, as it did not contain much information. A menu would in this case only caused the panel to be more troublesome to handle. If the model would have included other sections as well, such as interior lights, it probably had been justified to add another view that held that section. Using a main-menu would have done switching between those two views.
### 3.11 Help-section

Adding a help-section gives answers to the most commonly questions from the user, without having to contact other sources. The help-section contains information, among others, about how the interface works and known problems.
4 Evaluation of the panel

In order to control and document the panel’s accuracy, the used signals were verified and the functions validated.

4.1 Verification of the panel

Checking the technical configuration, e.g. signals and voltage-levels, is called verification. In this case, the signal-configuration was checked to determine if it corresponded to the reference. As reference the Statemate-model was used. It is the auto-generated simulation from the 3FD-method.

![Figure 14 – The simulation reference from Statemate](image)

It was discovered that a few signals were missing in the RNA-models.

4.2 Validating the functions

When behavioural/functionality tests are done, it is called to validate.

The panel was validated against the Statemate-model, so that the behaviour did not differ in any way. Due to the fact that some signals were missing in the RNA-models, the functions depending on those signals did not work correctly.
All bitmap-pictures were checked. The visual appearance was equal to what was expected, when a certain signal was applied.

### 4.3 Problems during the realization

Problems that occurred during the realization-phase are accounted for in this chapter.

#### 4.3.1 Concealed objects

Unfortunately, there is no way to hide objects in a panel. The usability would have increased if the objects could be dynamically hidden under program execution. As it is, the user must keep in mind, what objects that can affect the panel in the particular case. This adds another source of error that could have been avoided if the software-tool were somewhat improved to support dynamically hiding.

#### 4.3.2 Missing signals

As the panel was verified it was discovered that signals were missing in the software-model.

The reason for this was that the 3FD-method was not in a final state when the model was generated, and the signals were manually added. Some signals were simply missed.
5 Realization of extended objectives

Creating the panels proved to be not as time-consuming as believed. To extend the dissertation-projects volume, some additional tasks were added. They are all a part of the continuation of developing the interface-panels in reality.

In order to understand and solve the problem with missing Environment-variables, the knowledge in this area had to be extended. The RNA-model was investigated together with the 3FD-method. The first attempt to manually add the missing Environment-variables in the final code failed. The reason for this turned out to be that the Environment-variables must be added in the Environment-variable Database in order to include them from the beginning of the 3FD-method.

5.1 How changes in models effects the panel

The interface-panel behaviour is affected by changes in the software-model. One question that aroused during the dissertation was, what happens to the interface-panel if the RNA-models are changed. Avoiding frequent interface-panel-changes is important since these minor code changes regularly appear during development-phases.

According to Ivan Wilson the panel itself would be reusable with no changes as long as the signal-names are not altered, and no extra signals are added. The only thing required is recompilation of the new code from previous steps in the 3FD-method.

5.2 Real node testing with panel

The panel will be used in test-situations, and affected by different hardware set-ups. Therefore one must examine how the behaviour of the panel changes.

To investigate how the panel behaved in a test-situation, the 3FD-rig (Figure 15) was obtained and the computer containing CANoe were connected to the rig’s CAN-interface.

To determine the differences between using the interface-panel with the system in simulation mode and using it with different real node(s), several possible combinations were tried out.
The panel could affect the rig, causing the rig to react upon actions executed in the panel. By making a “force entry” in the panel, the rig reacted as well and indicating an alarm. The results were documented, view appendix C.

Alarming-indication differed inconsequently during the test.

Problems that occurred during the test are stated in chapter 5.5.
5.3 Instrument panel simulation

Saab launched a small 3FD-project in real life during the dissertation, in order to create an instrument-panel simulation and prove the overall possibilities when using the 3FD-method. The goal was to connect the simulated interface-panel (together with a corresponding software-model) to a car, and achieve the same behaviour from the real instrument panel.

As a part of this, the group created and implemented a functional instrument panel into CANoe.

![Simulated instrument panel](image)

The simulated instrument panel was very close to the reality. The only thing that differed was a small inaccuracy with the trip-counter. It differed slightly due to a multiplication-factor, which was wrong in the RNA-model.

5.4 Alternative software

Vector was contacted regarding the non-existing feature to conceal objects in panels. No such plan existed to implement such a feature in the nearest future versions of CANoe.

A market analyse for other alternative software were made due to the limitations in CANoe’s Panel Editor. Following companies were inquired in order to see if they had a usable software-solution:

- Jor AB
- I+ME
- Mecel
- Kvaser
- Dearborn
Only one alternative was found; Kvaser AB had a new software-solution called Creator. Creator is Kvaser’s correspondence to Vector’s CANoe.

Creator was released at the end of the dissertation-project and was just briefly examined. Creator’s Panel Editor has more features than CANoe’s, but the software is not fully developed yet, some options do not affect anything.

5.5 Problems during the realization of extended tasks

Some problems that occurred during the realization of extended tasks are stated in this chapter.

5.5.1 Add missing signals to the model

As the panel was verified it was discovered that signals were missing in the RNA-models. The first attempt to manually add the missing signals failed; they must be added in the signal-database that is generated in the 3FD-process.

5.5.2 Inconsequent sensor trigging

The way of how the sensors were trigged varied during the testing, for example was the alarm trigged by the system occasionally. The reasons for this behaviour could not truly be determined and it was therefore difficult to get rid of these faults.
6 Results

All results that were obtained are accounted for in this chapter.

6.1 Interface-panel

An interface panel was successfully created and implemented in CANoe.

![Final interface-panel](image)

Figure 17 – Final interface-panel

The ergonomics, function-owners and test-engineers were satisfied.

6.2 Interface-panel verification

It was discovered that a few signals were missing in the RNA-models.

6.3 Interface-panel validation

The functions depending on the missing signals in the RNA-models did not work correctly.

The visual appearance (of bitmap-pictures) was equal to what was expected, when a certain signal was applied.
6.4 **How changes in models effects the panel**

According to Ivan Wilson the panel itself would be reusable with no changes as long as the signal-names are not altered, and no extra signals are added. The only thing required is recompilation of the new code from previous steps in the 3FD-method.

6.5 **Real node testing with panel**

Alarming-indication differed inconsequently during the test.

Using the panel in coherence with physical hardware caused some problems. Non-bussed signals were lost and some loss of data was also observed.

The way of how the sensors were trigged varied during the testing. The system trigged the alarm occasionally, without interference from the group’s tester.

6.6 **Instrument-panel simulation**

The result proved that the appearance of a simulated panel could be very close to reality. The only thing that proved to have a small inaccuracy was the trip-counter; that differed slightly due to a multiplication-factor, that was wrong in the software-model.

6.7 **Alternative software**

Since only one alternative software (that were still under early development) were found, there are no results from the market analyse.
7 Analyse and conclusions of results

We reached the main goal, to create an ergonomic and easy to use interface-panel for CANoe. The extended tasks proved that some issues, stated below, needs further investigation.

7.1 Interface-panel verification

The reason for signals missing in the RNA-models was that the 3FD-method was not in a final state when the model was generated, and the signals were manually added. Some signals were simply missed.

With automatic signal generating and simulation-testing in the 3FD-method this problem will be solved.

7.2 Interface-panel validation

Due to the fact that some signals were missing in the RNA-models, the functions depending on those signals did not work correctly.

With automatic signal generating and simulation-testing in the 3FD-method this problem will be solved.

7.3 Real node testing with panel

The group could not determine the reason for the inconsequently alarm-indication. The reasons for inconsequent sensor trigging and data-loss could not truly be determined either and it was therefore difficult to get rid of these faults.

The computer used in the particular case was old and could not keep up the face with the bus in real time. CANoe recommended a simulation speed setting that was far from real-time.

The group’s conclusions:

The timing issues may have caused the inconsequent sensor trigging and loss of data when using the interface-panel in coherence with the 3FD-rig. Another reason for this behaviour may be that the executions of the models demands more computer-power. A new, faster computer would very likely solve these problems.
8 Recommended future studies

If the panel is to be used for test-purposes in the future, some issues may be investigated in order to improve the method.

8.1 Use of the interface-panel for testing

To be able to use interface-panels for evaluation, it is necessary to properly investigate how the problems, stated in the Problem-chapters 4.3 and 5.5, can be solved.

8.2 Treating non-bussed signals

In order to use the panel in regular testing, the problem regarding the non-bussed signals ought to be solved.

We came up with a theory for the solution. It is an interface-box; that would act as a link between CANoe and the non-bussed signals. The interface-box would only have to convert the voltage of the non-bussed signals, so that they could be connected to a computer-interface. The logic itself is implemented in code, and therefore easy to alter.

Figure 18 – Interface-box set-up

Adding minor code changes in the software-model would enable the panel to receive/transmit and process non-bussed signals via, for example, the parallel port. The code-modifications would very likely be easy to implement in the 3FD-process, and therefore added automatically.

The interface-box itself will by this solution be as simple as possible and re-usable, as long as the number of signals does not pass beyond the number of in/out-ports, and no specification changes in the node/network regarding voltage-levels and connectors.
9 List of references

Andrén Peter, Gunnarsson Stefan, Lundin Joakim, 1993, Grafiska användargränssnitt – en utvecklingshandbok, Studentlitteratur, Lund

Fawcett Susan, Sandberg Alvin, 2000, Evergreen – A guide to writing, Haughton Mifflin Company, Boston (USA), Sixth Edition

Gulliksen Jan, Johansson Bengt, 2002, Användarcentrerad systemdesign, Studentlitteratur, Lund

Lillskog, Ulf, Svensson, Ola, Wilson, Ivan, 2002, 3FD-RNA Final Report.doc, Saab internal document, Department TLD

Lindmark, Niclas, 2001, RNAtechwDraftA.PDF, Saab internal document, Department TLEC

Mårdsjö Karin, 1986, Informera om teknik, Almqvist&Wiksell Ekonomiförlagen, Malmö, Upplaga 1:2

Nyström, Svante, 1999, Projekt som undervisningsform, Institutionen för Teknik, Högskolan i Trollhättan/Uddevalla, Trollhättan

Sandén, Ulf, Karlsson, Nicklas G, 2001, FunctionrevW103-104, Saab internal document, Department TLEB

Schött Kristina, m fl. 1998, Studentens skrivhandbok, Almqvist&Wiksell, Angered

Svensson, Bror-Erik, Westermark, Tobias, Projektbeskrivning – Billika användarinterface för simuleringsmodeller i CANoe, Institutionen för Teknik, Högskolan i Trollhättan/Uddevalla, Trollhättan

Walla, Erik 1990, Så skriver du bättre tekniska rapporter, Studentlitteratur, Lund
Appendix A – A brief description of the 3FD-method

The RNA-models (RNA – Reusable Node Architecture) used in the simulations are derived from the 3FD-project (3FD - Fast Formal Function Development), briefly described below.

![Diagram of the 3FD-method]

Figure 19 – steps in the 3FD-method (Lillskog, Ulf, 2002)

To reduce time for developing the body electronics in the car, the 3FD-method can be used. The 3FD-method focuses on functionality, and the first step in the 3FD-method is to determine the functionality.

The functionality is described graphically in the software Statemate Magnum, in form of a flowchart with conditions and iterations. Small sections of C-code can be included as well in order to describe more advanced functionality. The Statemate-model may be used as a part of the functional specifications.
Figure 20 - Speedometer-function in Statemate Magnum

Statemate Magnum exports the functionality to Rhapsody MicroC, which generate the C-code for the logical RNA-blocks automatically.
Figure 21 - The 3FD-process in a software-perspective (Lillskog, Ulf, 2002)

The result from Statemate Magnum is also exported to the software Slate that automatically allocates the functions between the nodes. The result from Slate exported to the program RNA Generator, which together with a tool called CANGen, generates the code for the GCL (Generic Communication Layer) and GMLan-kernel / LIN-kernel. The GCL is depending on API-functions (API – Application Program Interface) obtained by the network kernel, OSEK.
The only thing that needs to be added manually is the code for the drivert-(Driver/converter) blocks. The drivert blocks are the interface between CANoe and the CAN-network. The signals missing (view chapter 4.3.2 in main report) should have been implemented in the Drivert blocks. This type of errors will not occur when the 3FD-method is in a final state; the drivert blocks would then be auto-generated.

When the 3FD-method is completed, it is possible, just by repeating the steps after Statemate, to reuse the Statemate-model and fit it to the specific hardware and protocol that has been chosen e.g. nodes containing a specific Motorola processor, using the CAN protocol.

The 3FD-method reduces development-time and prevents expensive and complicated modifications due to insufficient hardware specifications.

For further information regarding the 3FD-method contact Niclas Lindmark, Department TLECA, Saab Automobile AB, Trollhättan.
User instructions

How to style an ergonomic and clear interface-panel for CANoe,
and tips regarding CANoe panels
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1 How to create a usable interface-panel

When styling an interface-panel, one must take in consideration several issues. If these issues, described in this chapter, are not taken serious more or less devastating failures can occur.

The information is gathered from co-worker on Saab Automobile and from literature dealing with HMI / MMI.

1.1 What is important to consider when designing panels

This chapter describes the basic issues to consider when designing an interface-panel, and exemplifies ways how to design them.

1.1.1 Pictures or text

The first thing that has to be determined when you are styling an interface-panel is whether you want to use a text- or graphic-based layout.

Text-based layouts can be preferable in some cases, but the most common used nowadays are graphic-based layouts, since pictures can say more than 1000 words. The effect that a picture can bring is so much more than a text.

If the graphic-based layout are badly styled and disposed, it can mislead the user to a wrong interpretation, choice or calculation. Text-based layout is preferable when you are dealing with hierarchical choices, like menu systems. Microsoft has got a combination of graphic and text; the menu system in MS Office is an example of this.

Technical applications often tend to contain too much text; text that must be read before the user can take any action. Ways to simplify the interface are to exchange the text or phrase into a symbol that can tell the user all at once.

It is difficult to determine if one should have text or symbols, so test both of them and see what you think of it when displayed. For example: the text “unlock” or a symbolic padlock with open shackles. The word “unlock” are clear if you are into the work and know English, but the unlocked padlock-symbol together with a locked padlock can tell the message in all languages.

Sometimes it can be hard to come up with a symbol that is clear and obvious. In such cases a describing text, as short as possible, can prove to be a better choice.

But a simple and useful illustration can both ease up the impression and make the interface more easy to use.
1.1.2 Merging colour and images

A symbol needs to be as clear as possible. Plain and clear symbols are better than symbols full of details. They catch the eye, and the users brain will remember it if there is a good likeness to the interpretation.

To increase the overall clarity, and for users with colour-blindness, it is useful if the symbol changes both in colour and shape when affected. Do not use only colour when designing interface-panels.

If you ought to display whether a door is locked or not, it is not wise to show this only by changing a colour indication on the door. Use the colour in combination with a padlock for instance. Then the colour and the symbol of an unlocked padlock can tell the user that the door is unlocked.

Using such over-explicitness may appear needless; but it prevents ambiguousness.

1.1.3 Disposition

A complicated system has usually many inputs and outputs that have to be convenient to handle and access. In order to avoid cluttering the interface-panel with both buttons and indicators, it is better to divide the interface-panel into different parts. The division can be of either functional- or logical type.

Each part must contain objects that are related to each other. The type of division must be consistent for all parts; i.e. if an interface-panel is divided according to functionality, it ought to be divided in a similar way all through the interface (i.e. panels, views).

For instance, if an interface consists as a complicated remote for a video, it can be suitable to hide some infrequently used buttons with a cover. At a first glance, the remote would look simple and only offer the functions that are familiar and daily used. The more advanced buttons is hidden and are not distracting the user. The daily use is simplified. When the user wants to use the more advanced functions, the buttons under the cover can be accessed easily.

In software, a similar separation can be achieved by dividing the interface into several, smaller windows.

1.1.4 Objects location in the panel

Object location depends on what the purpose of the information is. If you have a control-interface, the most common buttons are preferably placed centrally. If the interface instead is focused on information to the user, the most common use of information ought to be placed centrally.

Do not place the objects in centre of the display but centrally. It is a big difference; an object placed in centre of the picture tends to be of less interest - if the display is used for hours at the time. The output in Error! Reference source not found. is placed centrally and not in centre.
Peter Andrén (1993) claim that the most important buttons should be placed in the lower right corner. An example of this is all pop-up windows that appear when events happen. Look at the placement of “OK” and “Cancel” next time you open a document through MS Word or next time you get a message on your computer.

As already mentioned, arrange the object according to what purpose you have of the panel. Then arrange the objects in a logical way within the area.

![Diagram of objects placement in panel](image)

**Figure 23 – Example of objects placement in panel**

### 1.1.5 Display size

There is no specific statement on how large an interface-panel should be. It depends on what type of information you are dealing with.

Is it a stand-alone application or is it used in combination with another application?

Do not make the interface-panel too small in order to use several applications together. The risk you endanger is that the interface-panel will be so small that it will be vague and unclear.

### 1.1.6 Framing and lines

Thomas Lindgren at the department of ergonomics, Saab Automobile, pointed out the effect on frames around different parts in the interface-panel.
You can also use the effect of changing the background colour in different parts of the interface-panel. Or you can dispose the interface-panel a way that clearly distinguish where one part ends and where the next one starts - invisible lines like the ones you use in text layouts.

![Figure 24 – Background colour disposition](image1)

![Figure 25 – Invisible line disposition](image2)

1.1.7 Separation of input and output objects

Standardization of layouts is normal in organisations, but be careful with the use of to standardized layouts when you styling interface-panels. There is a risk that parts will be too similar to each other; the user will lose track of the objects locations.

As mentioned in previous chapter one solution can be to have different background colour for each part and distinguished different colour between input and output, as shown in Error! Reference source not found..
Another solution is to alter the style of buttons and indicators et cetera so the user can see the difference between e.g. a command button and an output indicator, see the difference between controls and output in Error! Reference source not found.. Something more Thomas Lindgren said was, if an object represents a button, it ought to look like a button and may not in any way look like an indicator or another object-type used in the interface-panel. Error! Reference source not found. is styled with difference between controllers and indicators. Note that there are a mixture of indicators and controllers in the Settings-part.

![Figure 27 – Example of correct and incorrect styling of buttons](attachment:figure27.png)

### 1.1.8 Greyscales

Using greyscale is to prefer before using colours. Both Thomas Lindgren (Ergonomics, Saab Automobile AB) and Bo Svensson (Lector at University of Trollhättan/Uddevalla) pointed out the importance of using greyscales when styling interface-panels. Error! Reference source not found. and Error! Reference source not found. are styled in grey in order to show the effect.

Greyscales are friendlier to the eye than colours, which can often be experienced as to sharp. Large views ought to be in greyscales. Otherwise they tend to be exhausting for the eyes and brain. Just look at the default settings in MS Office; all parts are grey except fore some smaller objects, which are coloured in order to make them more apparent.

It is recommended to use colour with moderation and only when something needs to be especially pointed out, such as “Warning”-messages; smaller object that tends to fade out in the picture, can with advantage be coloured as well.

### 1.1.9 Divide into sub-panels

If the projects design tends to be large and much space is needed, an alternative can be to divide the interface-panel into several smaller sub-panels. Thomas Lindgren told us to divide all panels in logical- or functional ways.

The department of ergonomics have divided their documents in physical parts. It is a graphic layout on a car; those that are interested in the ergonomic shape of an object, he only needs to click on the area he are of interest. The main picture leads to documents or underlying pictures with new choice.

NOTE: The main panel should be accessible easy at all time!
1.2 How to style with usability

The priority when styling an interface like a panel must be the usability. If an interface lacks the usability, the effort would have been carried out in vain; no one will use the interface even if everything else is to satisfaction.

This chapter describes issues to consider when styling an interface-panel in an ergonomic and interactive way.

1.2.1 Interaction

How the information flows between man and machine is called interaction. When the user gives an input to the machine, the machine reacts and ought to give the user some type of confirmation on what happened - and if the operation was carried out successfully. It can be anything from ‘OK’ to open a new panel-view.

One must take the interaction into consideration from the beginning, because the interaction is much more than just an appearance on a screen. It is directly affected by how the systems functions, which usually is the very first thing to be specified. It is not possible to change the interaction at the end, without changing the functionality as well.

A good interaction is one of the key-factors when styling an easy to use interface.

1.2.2 Styling with the user in mind

It is essential to listen to, and incorporate usable user-opinions in the design.

It is not the stylist and designer who are to be using the interface; it is the user, so why not asking them what they want!?

1.2.3 Indicating what objects are affected

To give the user an indication that his/hers choice or command has been received by the program, it is necessary to give a response.

The response can be anything from a look of the button being pressed to a message window appearing.

A message window can be used as a command check. Information to the user can be given, if the choice can lead to critical conditions. In order to proceed and execute the command the user has to approve the command and the risk that it in holds; clicking OK must approve it in holds, e.g. throwing files in Explorer.

Figure 28 – Difference between non-pressed and pressed button
1.2.4 Conceal objects

Objects (e.g. buttons) that change behaviour dynamically depending on the model-status that sometime is disabled, would preferable have the property of concealing. When using concealed objects, the user does not have to see any of the objects that are not essential. Concealing objects reduce the amount of information and concentrates on what is important at a certain situation.

To give an impression whether an object is disabled or not they can be greyed out. This is the usual case in Microsoft applications: Word, Excel etc.

1.2.5 Response from affected objects

To give the user feedback when the object is affected is a good way to make a panel ergonomic. In order to achieve this you can animate the buttons – e.g. so they appear to be dejected when the user affects them. Another example is a light bulb-symbol that emits light in form of small lines when it is active.

If the user cannot truly determine if an object is activated or not, the styling is not good enough. When computerised panels are styled it is effective to use advanced photo-editor programs, e.g. Paint Shop Pro or Photoshop. They are easy to work with and have good functions to use for effect-making pictures.

1.2.6 Help-section

It is useful to include some kind of help.

Try to work out all possible situations the user can be put into, and state a solution to the problem. It can be anything from what he has to do if the signal-name is changed, to how to change simulation-speed.
1.2.7 Unpredicted events

It is important to prevent unpredictable events from happening. These events, that seem to occur for the wrong reason or even no reason at all, may be one of the most annoying things from the users point of view. There are sometimes no way to understand them and learn a solution to avoid them.

NOTE: It is of great concern to remove any unpredictable behaviour.

2 Installation description of CANoe 44x models

On GMLan’s Info Center \st2file1\kravs\P_440\IAT\EA\GmlanKernel\WebSite\index.htm lie CANoe-models for the 44x models.

Needed are: ”Files to be placed… “, ”CANoemodel (pd024909.zip)” and ”New CAPLcomp.dll”, if you use CANoe 3.x

1. Copy following files to the EXEC32 folder in CANoe’s program folder:
   gmlan02.dll
   osek_tp.dll
   gmlan.ini
   osek_tp.ini
   seqFile.dll
   CAPLcomp.dll (if you use CANoe 3.x)
   (E.g.. C:\Program Files\CANoeWin32\Exec32\)

2. Open the files can.ini and capl.ini – and make following changes:

   Can.ini
   a) Include an dll-fil to CANoe (used for binary file access)
       ..........................................................
       [SIMULATION]
       // CAPLDLL=dllname.dll  -> tells the compiler and browser which CAPL-DLL to
       // consider for Compilation
       CAPLDLL=seqFile.dll
       ..........................................................
   b) Change to correct path for diagnostic (binary access)
       ..........................................................
       [CAPL]
       SeqFilePath=”C:\CANoe\SAAB\data\” (The folder where you saved the CANoe models
       pd024909)
       ..........................................................
   Capl.ini (this file can be named Capl.In_ Change it in that case to Capl.ini)
a) Change to correct path for diagnostic (ascii access)

……………….

[CAPL-INI]
Display=0   // display=0/1, 1: The Files that will be loaded are displayed
            // in the write.windows after start of the
            // measurement
FilePath="C:\CANoe\SAAB\data"  (The folder where you saved the CANoe models
pd024909)

MaskCount=1 // number of mask entries in this file
Mask1=*.txt  // file(s) that will be accessed from CAPL

……………….

3. In order to start CANoe with the models, mark the CANoe-shortcut and choose "Properties"

Type the path to the folder where the models are located – in ”Start in”
(e.g. C:CANoe\SAAB for this example)

Add the model configurations file-name – in ”Target”
(e.g. ”C:\Program Files\CANoeWin32\Exec32\canoe32.exe" ALL_44x_MAY_02.cfg)

4. Make sure that CANoe is configured correctly:
   Configure->Simulation… -> simulated or real bus

5. Compile all nodes. CANoe will notify for about 1100 warnings. The reason for this is that the
   compiler does not like names with similar names (e.g. name.can, name1.can etc.). CANoe can be
   executed in spite of the warnings.

6. Run CANoe and notice the animation factor that CANoe recommends:
   Ex. Warning: The bus transmit time resulting from selected baud rate
   cannot be simulated accurately with current animation factor!
   ->next possible animation factor for accurate simulation: 29
   Set the animation factor in Configure->Simulation…
3 How to create a bitmap-button in CANoe’s Panel Editor

The bitmap picture contains one ground picture to the left. To the right, pictures of the same size are added. The number of pictures added, have to be equal to the number of states in the signal, e.g. if a traffic light is red when the signal is null, the first picture (after the ground picture) is to be red. The second image would be yellow and the final image (third picture after the ground picture) green.

<table>
<thead>
<tr>
<th>Picture</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Value</td>
<td>-</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

![Figure 30 – Example of bitmap-picture](image_url)

Setting a bitmap-button is done by:

- Pull a button to the workspace and **double click** on it;
  A setting box appears,
- Decide if it should be a button or an indicator
- Set the number of states,
  The number of states is one less then the number of bitmap pictures
- Choose the controlling/controlled signal,
- The set up is finished.

If the picture appears to be cut-trough-the-middle or if the object shows more then one picture at a time, the first thing recommended is to use the **Adjust Size** function. To use it right click on the bitmap object and select **Adjust Size**. If this does not solve the problem, the number of states is probably incorrect. Re-enter the menu and change the state option.

4 How to add an interface-panel in CANoe

When the panel is finished, it can be added to CANoe by:

- Click on the **Panel** menu,
- Choose **Configure Panels**,
- Click the **Add Panel**-button, and choose the current panel,
- Select the name of the panel, in the window above, and press the **Display**-button
- Click **OK** and the panel appear, movable to the wanted position.

After that chose **Save Positions** and **OK**
5 Best way to edit an interface-panel

In order to *edit* an interface-panel it is recommendable to go trough CANoe’s panel menu. **Do not open the panel in Panel Editor, make correction and update in CANoe.** Updating in CANoe is troublesome.

Follow the list below and there will be no trouble:
- Click in the Panel menu,
- Choose interface-panel to edit,
- Click on the Edit Panel-button;
  Panel Editor will start and the panel will be opened,
- Edit the panel and save,
- Switch back to CANoe,
- Click OK and the panel will be updated.

6 Adapting Virtual CAN-drivers to CANoe

CANoe needs the CAN-card to communicate with the CAN-bus. When simulating it is not needed to connect to the CAN-bus in order to run the program, the CAN-card can simulate the CAN-bus. Newer versions of CANoe are delivered with drivers for virtual channels. With these drivers installed CANoe does not need the CAN-card in order to simulate.

When these device-drivers are installed one must manually change the configuration to use the new device-drivers.
This is achieved by:

1. Open *Can Hardware* in the control panel,

2. Select *CANoe1* in the list, by extending *CANCardX*,
   Right-click and select *Virtual CAN-bus 1*,

3. Proceed in the same way when configuring channel 2, but choose *Virtual CAN-bus 2*

4. Another option to obtain the correct configuration is to right-click on the virtual channels and choose what CAN-channel that shall be associated with it (This is valid for the other CAN products as CANalyzer, CANape etc),

5. When CANoe starts, make sure that the boot-screen contains the text *Virtual CAN*. 

![Figure 31 – CANoe associating alternative 1](image1)

![Figure 32 – CANoe associating alternative 2](image2)

![Figure 33 – CANoe start-picture](image3)
7 List of reference

Andrén Peter, Gunnarsson Stefan, Lundin Joakim, 1993, Grafiska användargränssnitt – en utvecklingshandbok, Studentlitteratur, Lund

Gulliksen Jan, Johansson Bengt, 2002, Användarcentrerad systemdesign, Studentlitteratur, Lund
Test results
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.
Appendix C

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### 4.17 Key Out Auto Unlocking

### 4.18 TSL Unlocking Key Inserted

### 4.19 Door Status Indication

### 4.20 Trunk Status Indication

### 4.21 Hood Status Indication

#### 4.21.1 Siren-/Horn Indication

### 4.22 Trigging Theft Deterrent

### 5 RDU without RLDM and RRDM (LIN connected)

#### 5.1 Lock Locally

#### 5.2 Unlock Locally

#### 5.3 Remote Locking

#### 5.4 Remote Unlocking

#### 5.5 Lock Passively

#### 5.6 Unlock Passively

#### 5.7 Unlock Driver Door Passively

#### 5.8 Unlock Passenger Door Passively

#### 5.9 Unlock Rear Right Door Passively

#### 5.10 Unlock Rear Left Door Passively

#### 5.11 Compartment Locking

#### 5.12 Compartment Unlocking

#### 5.13 Trunk Unlock Locally

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#### 5.19 Door Status Indication

#### 5.20 Trunk Status Indication

#### 5.21 Hood Status Indication

#### 5.21.1 Siren-/Horn Indication

#### 5.22 Trigging Theft Deterrent

### 6 RDU with RLDM (Lin connected)

#### 6.1 Lock Locally

#### 6.2 Unlock Locally

#### 6.3 Remote Locking

#### 6.4 Remote Unlocking

#### 6.5 Lock Passively

#### 6.6 Unlock Passively

#### 6.7 Unlock Driver Door Passively

#### 6.8 Unlock Passenger Door Passively

#### 6.9 Unlock Rear Right Door Passively

#### 6.10 Unlock Rear Left Door Passively

#### 6.11 Compartment Locking

#### 6.12 Compartment Unlocking
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**Test results**

Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

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This test has been done for evaluation of the CANoe panel, with real nodes.

Tester: Tobias Westermark TLECAX 0520-(2)79 620

This test is made to determine which objects are affected in the panel and what commands are possible.

The test is divided into which nodes are real; rest of the nodes are simulated with RNA-models.

8 CDU

8.1 Lock Locally

CANoe
Fuel lid indication NOK
LED indication NOK
Horn indication NOK

Rig
Siren-/horn indication is functioning (one blink).
LED indication OK

8.2 Unlock Locally

CANoe
Fuel lid indication NOK

Rig
Siren-/horn indication is functioning in the rig (tow blink).

8.3 Remote Locking

CANoe
Fuel lid indication NOK
LED indication NOK

Rig
Siren-/horn indication is functioning (one blink).
LED indication OK

8.4 Remote Unlocking

CANoe
**Fuel lid indication NOK**

**Rig**
Siren-/horn indication is functioning in the rig (tow blink).

### 8.5 Lock Passively

**CANoe**
- Fuel lid indication NOK
- LED indication NOK
- Horn indication NOK

**Rig**
Siren-/horn indication is functioning (one blink).
- LED indication OK

### 8.6 Unlock Passively

**CANoe**
- Fuel lid indication NOK

**Rig**
Siren-/horn indication is functioning in the rig (tow blink).

### 8.7 Unlock Driver Door Passively

Functions as expected

### 8.8 Unlock Passenger Door Passively

Functions as expected

### 8.9 Unlock Rear Right Door Passively

Functions as expected

### 8.10 Unlock Rear Left Door Passively

Functions as expected

### 8.11 Compartment Locking

**CANoe**
- Fuel lid indication NOK

**Rig**
Siren-/horn indication is functioning (one blink).

8.12 Compartment Unlocking

CANoe
Fuel lid indication NOK

8.13 Trunk Unlock Locally
Functions as expected

8.14 Trunk Unlock Passively
Functions as expected

8.15 Trunk Compartment Switch
Functions as expected

8.16 Trunk Handle Switch
Functions as expected

8.17 Key Out Auto Unlocking

CANoe
Lock indication shows doors unlocked.

Rig
Locks does not unlock

Rig activation is functioning.

8.18 TSL Unlocking Key Inserted
Functions as expected

Both in rig and in CANoe
**Appendix C**

**Test results**
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

---

**8.19 Door Status Indication**

**CANoe**

Door status indication shows doors closed when doors are opened in rig.

---

**8.20 Trunk Status Indication**

**CANoe**

Trunk opens when trunk is opened, but it does not closes when the trunk lid is closed.

---

**8.21 Hood Status Indication**

**CANoe**

Opening the hood on the rig is not indicated on panel.

---

**8.21.1 Siren-/Horn Indication**

**CANoe**

Either siren or horn is indicating theft deterrent.

**Rig**

Indicate as expected

---

**8.22 Trigging Theft Deterrent**

**Driver Door**

Trigs on rig activation

**Passenger Door**

Trigs on rig activation

**Rear Right Door**

Not functioning

**Rear Left Door**

Trigs on rig activation

**Hood**

Trigs on panel activation

**Trunk**

Trigs on rig activation
Test results
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

Glass Break Detection
Not functioning

Ultra Sonic Detection
Not functioning

Tilt Detection
Not functioning

9 CIM

9.1 Lock Locally
CANoe
Activation from the panel is not functioning.

If locked in the rig all indications are displayed in the panel.

Rig
Locking in rig functions as expected.

9.2 Unlock Locally
CANoe
Activation from the panel is not functioning.

If unlocked in the rig all indications are displayed in the panel.

Rig
Unlocking in rig functions as expected.

9.3 Remote Locking
CANoe
Activation from the panel is not functioning.

If locked in the rig all indications are displayed in the panel.

Rig
Locking in rig functions as expected.
9.4 Remote Unlocking

CANoe
Activation from the panel is not functioning.

If locked in the rig all indications are displayed in the panel.

Rig
Unlocking in rig functions as expected.

9.5 Lock Passively

CANoe
Not functioning

Rig
Not functioning

9.6 Unlock Passively

CANoe
Not functioning

Rig
Not functioning

9.7 Unlock Driver Door Passively

Not functioning

9.8 Unlock Passenger Door Passively

Not functioning

9.9 Unlock Rear Right Door Passively

Not functioning

9.10 Unlock Rear Left Door Passively

Not functioning

9.11 Compartment Locking

CANoe
OK
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Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

Infoklass/Info Class
Godkänd/Approved

by

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Lagringdata/File

Reg nr/Reg no

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Rig
OK

9.12 Compartments Unlocking

CANoe
OK

Rig
OK

9.13 Trunk Unlock Locally

Functions as expected

9.14 Trunk Unlock Passively

Activates Theft Deterrent

9.15 Trunk Compartment Switch

Not functioning

9.16 Trunk Handle Switch

CANoe
OK

Rig
OK

9.17 Key Out Auto Unlocking

CANoe
Lock indication shows doors unlocked.

Key In/Out is not displayed in panel.

Rig
Locks are unlocked

Rig activation is not functioning.

**9.18 TSL Unlocking Key Inserted**

Functions as expected

Both in rig and in CANoe

**9.19 Door Status Indication**

CANoe

Door status indication shows doors closed when doors are opened in rig.

**9.20 Trunk Status Indication**

CANoe

Trunk opens when trunk is opened, but it does not closes when the trunk lid is closed.

**9.21 Hood Status Indication**

CANoe

Opening the hood on the rig is not indicated on panel.

**9.21.1 Siren-/Horn Indication**

CANoe

Siren and horn is indicating theft deterrent.

Rig

No indication

**9.22 Trigging Theft Deterrent**

Driver Door

Trigs on panel activation

Passenger Door

Trigs on rig activation
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Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

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Rear Right Door
Trigs on panel activation

Rear Left Door
Trigs on panel activation

Hood
Trigs on panel activation

Trunk
Trigs on panel activation

Glass Break Detection
Not functioning

Ultra Sonic Detection
Not functioning

Tilt Detection
Not functioning

10 DDM
Trunk Lock opened in rig trigs Theft Deterrent at arming.

10.1 Lock Locally
CANoe
Activation from the panel is functioning.

All indicators are functioning but Driver Door Lock Status

Theft deterrent activates after Arming Time

Rig
Locking in rig is not functioning.

10.2 Unlock Locally
CANoe
Activation from the panel is functioning.

All indicators are functioning but Driver Door Lock Status
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Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

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Utgåva/Issue

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10 (43)

Rig
Unlocking in rig is not functioning.

10.3 Remote Locking
CANoe
Activation from the panel is functioning.

All indicators are functioning but Driver Door Lock Status

Theft deterrent activates after Arming Time

Rig
Locking in rig is not functioning.

10.4 Remote Unlocking
CANoe
Activation from the panel is functioning.

All indicators are functioning but Driver Door Lock Status

Rig
Unlocking in rig is not functioning.

10.5 Lock Passively
CANoe
Activation from the panel is functioning.

All indicators are functioning but Driver Door Lock Status

Theft deterrent activates after Arming Time

Rig
Locking in rig is not functioning.

10.6 Unlock Passively
CANoe
Activation from the panel is functioning.

All indicators are functioning but Driver Door Lock Status
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Test results
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

Rig
Unlocking in rig is not functioning.

10.7 Unlock Driver Door Passively
Activation from the panel is functioning.

Driver Door Lock Status indication is not functioning.

10.8 Unlock Passenger Door Passively
Functions as expected

10.9 Unlock Rear Right Door Passively
Functions as expected

10.10 Unlock Rear Left Door Passively
Functions as expected

10.11 Compartment Locking
CANoe
Activation from the panel is functioning but only Passenger Door button.

All indicators are functioning but Driver Door Lock Status

Rig
Locking in rig is functioning for both Driver- and Passenger Door buttons.

10.12 Compartment Unlocking
CANoe
Activation from the panel is functioning but only Passenger Door button.

All indicators are functioning but Driver Door Lock Status

Rig
Locking in rig is functioning for both Driver- and Passenger Door buttons.
10.13 Trunk Unlock Locally
Functions as expected

10.14 Trunk Unlock Passively
Functions as expected

10.15 Trunk Compartment Switch
Not functioning

10.16 Trunk Handle Switch
CANoe
OK

Rig
OK

10.17 Key Out Auto Unlocking
CANoe
Indicators in panel are unlocked, but rig locks are not unlocked.

Rig
Not functioning

10.18 TSL Unlocking Key Inserted
CANoe
Indicators in panel are unTSLed, but rig locks are not unTSLed.

When the key is taken out, the locks are unTSLed and unlocked.

Rig
Not functioning

10.19 Door Status Indication
CANoe
Door status indication shows doors closed when doors are opened in rig.

10.20 Trunk Status Indication

CANoe
Trunk opens when trunk is opened, but it does not closes when the trunk lid is closed.

10.21 Hood Status Indication

CANoe
Opening the hood on the rig is not indicated on panel.

10.21.1 Siren-/Horn Indication

CANoe
Siren and horn is indicating theft deterrent.

Rig
No indication

10.22 Trigging Theft Deterrent

Driver Door
Trigs on rig activation

Passenger Door
Trigs on rig activation

Rear Right Door
Trigs on panel activation

Rear Left Door
Trigs on rig activation

Hood
Trigs on rig activation

Trunk
Activation varies

Glass Break Detection
Trigs on panel activation

**Ultra Sonic Detection**
Trigs on panel activation

**Tilt Detection**
Trigs on panel activation

### 11 FDU
Trunk Lock opened in rig trigs Theft Deterrent at arming.

#### 11.1 Lock Locally

**CANoe**

Activation from the panel is functioning.

All indicators are functioning but front blinkers

**Rig**

Locking in rig is not functioning.

Front blinkers indicating in rig

#### 11.2 Unlock Locally

**CANoe**

Activation from the panel is functioning.

All indicators are functioning but front blinkers.

**Rig**

Unlocking in rig is not functioning.

Front blinkers indicating in rig

#### 11.3 Remote Locking

**CANoe**

Activation from the panel is functioning.

**Rig**

Locking in rig is not functioning.
11.4 Remote Unlocking

**CANoe**
Activation from the panel is functioning.

**Rig**
Unlocking in rig is not functioning.

11.5 Lock Passively

**CANoe**
Activation from the panel is functioning.

All indicators are functioning but front blinkers.

**Rig**
Locking in rig is not functioning.

Front blinkers indicating in rig

11.6 Unlock Passively

**CANoe**
Activation from the panel is functioning.

All indicators are functioning but front blinkers.

**Rig**
Unlocking in rig is not functioning.

Front blinkers indicating in rig

11.7 Unlock Driver Door Passively

Functions as expected

11.8 Unlock Passenger Door Passively

Functions as expected

11.9 Unlock Rear Right Door Passively

Unlocks both front and rear locks on left side.
11.10 Unlock Rear Left Door Passively

Unlocks both front and rear locks in right side.

11.11 Compartment Locking

CANoe

Functions as expected

Rig

Functions as expected

11.12 Compartment Unlocking

CANoe

Functions as expected

Rig

Functions as expected

11.13 Trunk Unlock Locally

All indicators are functioning but the front blinkers, that are indicating on the rig.

11.14 Trunk Unlock Passively

Functions as expected

11.15 Trunk Compartment Switch

Functions as expected

11.16 Trunk Handle Switch

CANoe

OK

Rig

OK
Test results
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

11.17 Key Out Auto Unlocking
Not functioning

11.18 TSL Unlocking Key Inserted
Not functioning

11.19 Door Status Indication
CANoe
Door status indication shows doors closed when doors are opened in rig.

11.20 Trunk Status Indication
CANoe
Trunk opens when trunk is opened, but it does not closes when the trunk lid is closed.

11.21 Hood Status Indication
CANoe
Opening the hood on the rig is not indicated on panel.

11.21.1 Siren-/Horn Indication
CANoe
Siren and horn is indicating theft deterrent.

Rig
No indication

11.22 Trigging Theft Deterrent
Driver Door
Trigs on panel activation

Passenger Door
Trigs on rig activation

Rear Right Door
Appendix C

Test results
Power lock and anti-theft deterrent functions tested – CANoe panel vs. RNA-nodes.

Godkänd/Approved By
Infoklass/Info Class

Dokumentnamn/Document Name
Test results
Power lock and anti-theft deterrent functions tested – CANoe panel vs. RNA-nodes.

Godkänd/Approved By

Telefax

Lagringsdata/File

Reg nr/Reg no

Utfärdare (intern postadress, namn)/Issued by
Telefon/Phone
Datum/Date
Utgåva/Issue
Sida/Page

TLECAX, A1-7, Tobias Westermark
+46 520 (2)79 620
2003-01-29
1
18 (43)

Not functioning. The first time it activated though the panel but then it stopped functioning.

Rear Left Door
Trigs on rig activation

Hood
Trigs on rig activation

Trunk
Activation varies

Glass Break Detection
Trigs on panel activation

Ultra Sonic Detection
Trigs on panel activation

Tilt Detection
Trigs on panel activation

12 RDU without RLDM and RRDM (LIN connected)

12.1 Lock Locally

CANoe
Activation from the panel is functioning

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

Rig
Locking in rig is not functioning

12.2 Unlock Locally

CANoe
Activation from the panel is functioning

All indicators are functioning but Driver Doors Lock Status and Rear Blinkers.

Rig
Unlocking in rig is not functioning
Appendix C

Test results
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

12.3 Remote Locking

CANoe
Activation from the panel is functioning

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

Rig
Locking in rig is not functioning

12.4 Remote Unlocking

CANoe
Activation from the panel is functioning

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

Rig
Unlocking in rig is not functioning

12.5 Lock Passively

CANoe
Activation from the panel is functioning

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

Rig
Locking in rig is not functioning

12.6 Unlock Passively

CANoe
Activation from the panel is functioning

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

Rig
Unlocking in rig is not functioning.

12.7 Unlock Driver Door Passively

Functions as expected
12.8 Unlock Passenger Door Passively
Functions as expected

12.9 Unlock Rear Right Door Passively
Unlocking from panel is working but no Lock Status Indication.

Passenger Door is unlocked.

12.10 Unlock Rear Left Door Passively
Unlocking from panel is working but no Lock Status Indication.

Both Rear Left Door and Driver Door are unlocked.

12.11 Compartment Locking
CANoe
Locking is working from the panel.

All indicators are functioning but Rear Doors Lock Status.

Rig
Locking in rig is functioning for both Driver- and Passenger Door buttons.

12.12 Compartment Unlocking
CANoe
Unlocking is working from the panel.

All indicators are functioning but Rear Doors Lock Status.

Rig
Locking in rig is functioning for both Driver- and Passenger Door buttons.

12.13 Trunk Unlock Locally
Unlocking is working from the panel, but Trunk Status Indication is not working in the panel.
Appendix C

Test results
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

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12.14 Trunk Unlock Passively
Functions as expected

12.15 Trunk Compartment Switch
Not functioning

12.16 Trunk Handle Switch
CANoe
Not functioning
Rig
OK

12.17 Key Out Auto Unlocking
CANoe
Functions as expected
Rig
Functions as expected

12.18 TSL Unlocking Key Inserted
CANoe
Indicators in panel are unTSLed, but rig locks are not unTSLed.
When the key is taken out the locks are unTSLed and unlocked.
Nor Rear Doors Lock Status or Rear Doors TSL Status is indicated in the panel.

Rig
Indicators in panel are unTSLed, but rig locks are not unTSLed.
When the key is taken out the locks are unTSLed and unlocked.
Nor Rear Doors Lock Status or Rear Doors TSL Status is indicated in the panel.
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Test results
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

12.19 Door Status Indication
CANoe
Door status indication shows doors closed when doors are opened in rig.

12.20 Trunk Status Indication
CANoe
Not functioning

12.21 Hood Status Indication
CANoe
Opening the hood on the rig is not indicated on panel.

12.21.1 Siren-/Horn Indication
CANoe
Siren and horn is indicating theft deterrent.

Rig
Not functioning

12.22 Trigging Theft Deterrent
Driver Door
Trigs on panel activation

Passenger Door
Trigs on rig activation

Rear Right Door
Not functioning

Rear Left Door
Not functioning

Hood
Trigs on rig activation

Trunk
Activation varies
Test results
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

Glass Break Detection
Trigs on panel activation

Ultra Sonic Detection
Not functioning

Tilt Detection
Not functioning

13 RDU with RLDM (Lin connected)

13.1 Lock Locally

CANoe
Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

Rig
Locking in rig is not functioning.

13.2 Unlock Locally

CANoe
Activation from the panel is functioning.

All indicators are functioning but Driver Doors Lock Status and Rear Blinkers.

Rig
Unlocking in rig is not functioning.

13.3 Remote Locking

CANoe
Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

Rig
Locking in rig is not functioning.
13.4 Remote Unlocking

**CANoe**
Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

**Rig**
Unlocking in rig is not functioning.

13.5 Lock Passively

**CANoe**
Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

**Rig**
Locking in rig is not functioning.

13.6 Unlock Passively

**CANoe**
Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

**Rig**
Unlocking in rig is not functioning.

13.7 Unlock Driver Door Passively

Functions as expected

13.8 Unlock Passenger Door Passively

Functions as expected

13.9 Unlock Rear Right Door Passively

Unlocking from panel is working but no Lock Status Indication.

Passenger Door is unlocked.
Appendix C

Test results
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

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13.10 Unlock Rear Left Door Passively
Unlocking from panel is working but no Lock Status Indication.

Both Rear Left Door and Driver Door are unlocked.

13.11 Compartment Locking
CANoe
Locking is working from the panel.

All indicators are functioning but Rear Doors Lock Status.

Rig
Locking in rig is functioning for both Driver- and Passenger Door buttons.

13.12 Compartment Unlocking
CANoe
Unlocking is working from the panel.

All indicators are functioning but Rear Doors Lock Status.

Rig
Locking in rig is functioning for both Driver- and Passenger Door buttons.

13.13 Trunk Unlock Locally
Unlocking is working from the panel, but Trunk Status Indication is not working in the panel.

13.14 Trunk Unlock Passively
Functions as expected

13.15 Trunk Compartment Switch
Not functioning

13.16 Trunk Handle Switch
CANoe
Test results
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

Not functioning

Rig
OK

13.17 Key Out Auto Unlocking

CANoe
Functions as expected

Rig
Not functioning

13.18 TSL Unlocking Key Inserted

CANoe
Indicators in panel are unTSLed, but rig locks are not unTSLed.

When the key is taken out the locks are unTSLed and unlocked.

Nor Rear Doors Lock Status or Rear Doors TSL Status is indicated in the panel.

Rig
Indicators in panel are unTSLed, but rig locks are not unTSLed.

When the key is taken out (from the panel, not the rig) the locks are unTSLed and unlocked.

Nor Rear Doors Lock Status or Rear Doors TSL Status is indicated in the panel.

13.19 Door Status Indication

CANoe
Door status indication shows doors closed when doors are opened in rig.

13.20 Trunk Status Indication

CANoe
Not functioning
13.21 Hood Status Indication

CANoe
Opening the hood on the rig is not indicated on panel.

13.21.1 Siren-/Horn Indication

CANoe
Siren and horn is indicating theft deterrent.

Rig
Not functioning

13.22 Trigging Theft Deterrent

Driver Door
Trigs on panel activation

Passenger Door
Trigs on rig activation

Rear Right Door
Not functioning

Rear Left Door
Not functioning

Hood
Trigs on rig activation

Trunk
Activation varies

Glass Break Detection
Trigs on panel activation

Ultra Sonic Detection
Not functioning

Tilt Detection
Not functioning
14 RDU with RRDM (LIN connected)

14.1 Lock Locally

CANoe
Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

Rig
Locking in rig is not functioning.

Rear Right Door lock is functioning.

14.2 Unlock Locally

CANoe
Activation from the panel is functioning.

All indicators are functioning but Driver Doors Lock Status and Rear Blinkers.

Rig
Unlocking in rig is not functioning.

Rear Right Door lock is functioning.

14.3 Remote Locking

CANoe
Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

Rig
Locking in rig is not functioning.

Rear Right Door lock is functioning.

14.4 Remote Unlocking

CANoe
Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.
Appendix C

Test results

Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

Rig

Unlocking in rig is not functioning.

Rear Right Door lock is functioning.

14.5 Lock Passively

CANoe

Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

Rig

Locking in rig is not functioning.

Rear Right Door lock is functioning.

14.6 Unlock Passively

CANoe

Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

Rig

Unlocking in rig is not functioning.

Rear Right Door lock is functioning.

14.7 Unlock Driver Door Passively

Functions as expected

14.8 Unlock Passenger Door Passively

Functions as expected

14.9 Unlock Rear Right Door Passively

Unlocking from panel is working but no Lock Status Indication.

Rear Right Door lock is functioning.
Both Rear Right Door and Passenger Door are unlocked.

14.10 Unlock Rear Left Door Passively
Unlocking from panel is working but no Lock Status Indication.

Both Rear Left Door and Driver Door are unlocked.

14.11 Compartment Locking
CANoe
Locking is working from the panel.

All indicators are functioning but Rear Doors Lock Status.

Rig
Locking in rig is functioning for both Driver- and Passenger Door buttons.

14.12 Compartment Unlocking
CANoe
Unlocking is working from the panel.

All indicators are functioning but Rear Doors Lock Status.

Rig
Locking in rig is functioning for both Driver- and Passenger Door buttons.

14.13 Trunk Unlock Locally
Unlocking is working from the panel, but Trunk Status Indication is not working in the panel.

14.14 Trunk Unlock Passively
Functions as expected

14.15 Trunk Compartment Switch
Not functioning
Appendix C

Test results
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

Godkänd/Approved

Infoklass/Info Class

Dokumentnamn/Document Name

Test results
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

14.16 Trunk Handle Switch

CANoe
Not functioning

Rig
OK

14.17 Key Out Auto Unlocking

CANoe
Lock Status indicates unlocking in panel but only Rear Right Door Lock is unlocked.

Rig
Functions as expected

14.18 TSL Unlocking Key Inserted

CANoe
Indicators in panel are unTLSed, but rig locks are not unTLSed.

When the key is taken out the Rear Right Door Lock are unTLSed and unlocked.

Nor Rear Doors Lock Status or Rear Doors TSL Status is indicated in the panel.

Rig
Indicators in panel are unTLSed, but rig locks are not unTLSed.

When the key is taken out the locks are unTLSed and unlocked.

Nor Rear Doors Lock Status or Rear Doors TSL Status is indicated in the panel.

14.19 Door Status Indication

CANoe
Door status indication shows doors closed when doors are opened in rig.

14.20 Trunk Status Indication

CANoe
Not functioning
### 14.21 Hood Status Indication

**CANoe**
Opening the hood on the rig is not indicated on panel.

### 14.21.1 Siren-/Horn Indication

**CANoe**
Siren and horn is indicating theft deterrent.

**Rig**
Not functioning

### 14.22 Trigging Theft Deterrent

**Driver Door**
Trigs on rig activation

**Passenger Door**
Trigs on panel activation

**Rear Right Door**
Trigs on both panel and rig activation

**Rear Left Door**
Trigs on both panel and rig activation

**Hood**
Trigs on panel activation

**Trunk**
Activation varies

**Glass Break Detection**
Trigs on rig activation

**Ultra Sonic Detection**
Trigs on rig activation

**Tilt Detection**
Trigs on rig activation
15 RDU with both RLDM and RRDM (LIN connected)

15.1 Lock Locally

CANoe

Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

Rig

Locking in rig is not functioning.

Rear Right Door lock is functioning.

15.2 Unlock Locally

CANoe

Activation from the panel is functioning.

All indicators are functioning but Driver Doors Lock Status and Rear Blinkers.

Rig

Unlocking in rig is not functioning.

Rear Right Door lock is functioning.

15.3 Remote Locking

CANoe

Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

Rig

Locking in rig is not functioning.

Rear Right Door lock is functioning.

15.4 Remote Unlocking

CANoe

Activation from the panel is functioning.
All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

**Rig**
Unlocking in rig is not functioning.

Rear Right Door lock is functioning.

**15.5 Lock Passively**

**CANoe**
Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

**Rig**
Locking in rig is not functioning.

Rear Right Door lock is functioning.

**15.6 Unlock Passively**

**CANoe**
Activation from the panel is functioning.

All indicators are functioning but Rear Doors Lock Status and Rear Blinkers.

**Rig**
Unlocking in rig is not functioning.

Rear Right Door lock is functioning.

**15.7 Unlock Driver Door Passively**

Functions as expected

**15.8 Unlock Passenger Door Passively**

Functions as expected

**15.9 Unlock Rear Right Door Passively**

Unlocking from panel is working but no Lock Status Indication.
Appendix C

Test results
Power lock and anti-theft deterrent functions tested – CANoe panel vs. RNA-nodes.

Both Rear Right Door and Passenger Door are unlocked.

Rear Right Door lock is functioning.

15.10 Unlock Rear Left Door Passively
Unlocking from panel is working but no Lock Status Indication.

Both Rear Left Door and Driver Door are unlocked.

15.11 Compartment Locking
CANoe
Locking is working from the panel.

All indicators are functioning but Rear Doors Lock Status.

Rig
Locking in rig is functioning for both Driver- and Passenger Door buttons.

15.12 Compartment Unlocking
CANoe
Unlocking is working from the panel.

All indicators are functioning but Rear Doors Lock Status.

Rig
Locking in rig is functioning for both Driver- and Passenger Door buttons.

15.13 Trunk Unlock Locally
Unlocking is working from the panel, but Trunk Status Indication is not working in the panel.

15.14 Trunk Unlock Passively
Functions as expected
Appendix C

Test results
Power lock and anti theft deterrent functions tested – CANoe panel vs. RNA-nodes.

15.15 Trunk Compartment Switch
Not functioning

15.16 Trunk Handle Switch
CANoe
Not functioning

Rig
OK

15.17 Key Out Auto Unlocking
CANoe
Lock Status indicates unlocking in panel but only Rear Right Door Lock is unlocked.

Rig
Functions as expected

15.18 TSL Unlocking Key Inserted
CANoe
Indicators in panel are unTSLed, but rig locks are not unTSLed.

When the key is taken out the Rear Right Door Lock are unTSLed and unlocked.

Nor Rear Doors Lock Status or Rear Doors TSL Status is indicated in the panel.

Rig
Indicators in panel are unTSLed, but rig locks are not unTSLed.

When the key is taken out the locks are unTSLed and unlocked.

Nor Rear Doors Lock Status or Rear Doors TSL Status is indicated in the panel.

15.19 Door Status Indication
CANoe
Door status indication shows doors closed when doors are opened in rig.
15.20 Trunk Status Indication

CANoe
Not functioning

15.21 Hood Status Indication

CANoe
Opening the hood on the rig is not indicated on panel.

15.21.1 Siren-/Horn Indication

CANoe
Siren and horn is indicating theft deterrent.

Rig
Not functioning

15.22 Trigging Theft Deterrent

Driver Door
Trigs on rig activation

Passenger Door
Trigs on rig activation

Rear Right Door
Trigs on both panel and rig activation

Rear Left Door
Trigs on both panel and rig activation

Hood
Trigs on panel activation

Trunk
Activation varies

Glass Break Detection
Trigs on panel activation

Ultra Sonic Detection
Trigs on panel activation

**Tilt Detection**
Trigs on panel activation

**16 PDM**
Trunk Lock opened in rig trigs Theft Deterrent at arming.

**16.1 Lock Locally**

**CANoe**
Activation from the panel is functioning.

All indicators are functioning but Passenger Door Lock Status.

**Rig**
Locking in rig is not functioning.

**16.2 Unlock Locally**

**CANoe**
Activation from the panel is functioning.

All indicators are functioning but Passenger Door Lock Status.

**Rig**
Unlocking in rig is not functioning.

**16.3 Remote Locking**

**CANoe**
Activation from the panel is functioning.

All indicators are functioning but Passenger Door Lock Status.

**Rig**
Locking in rig is not functioning.
16.4 Remote Unlocking

CANoe
Activation from the panel is functioning.

All indicators are functioning but Passenger Door Lock Status.

Rig
Unlocking in rig is not functioning.

16.5 Lock Passively

CANoe
Activation from the panel is functioning.

All indicators are functioning but Passenger Door Lock Status.

Rig
Locking in rig is not functioning.

16.6 Unlock Passively

CANoe
Activation from the panel is functioning.

All indicators are functioning but Passenger Door Lock Status.

Rig
Unlocking in rig is not functioning.

16.7 Unlock Driver Door Passively

Functions as expected

16.8 Unlock Passenger Door Passively

Passenger Door is unlocked but no Lock Status Indication.

16.9 Unlock Rear Right Door Passively

Unlocking from panel is working but no Lock Status Indication.
Passenger Door is unlocked.

**16.10 Unlock Rear Left Door Passively**

Both Rear Left Door and Driver Door are unlocked.

**16.11 Compartment Locking**

**CANoe**

Only Driver Door button is working from the panel.

All indicators are functioning but Passenger Doors Lock Status.

**Rig**

Locking in rig is functioning for both Driver- and Passenger Door buttons.

**16.12 Compartment Unlocking**

**CANoe**

Only Driver Door button is working from the panel.

All indicators are functioning but Passenger Doors Lock Status.

**Rig**

Locking in rig is functioning for both Driver- and Passenger Door buttons.

**16.13 Trunk Unlock Locally**

Unlocking is working from the panel, but Trunk Status Indication is not working in the panel.

**16.14 Trunk Unlock Passively**

Functions as expected

**16.15 Trunk Compartment Switch**

Functions as expected
16.16 Trunk Handle Switch

CANoe
OK

Rig
OK

16.17 Key Out Auto Unlocking

CANoe
Not functioning

Rig
Functions as expected

16.18 TSL Unlocking Key Inserted

CANoe
Indicators in panel are unTSLed, but rig locks are not unTSLed.

Passenger Door TSL Status is not indicated in the panel.

Rig
Indicators in panel are unTSLed, but rig locks are not unTSLed.

When the key is taken out the locks are unTSLed and unlocked.

Passenger Door TSL Status is not indicated in the panel.

16.19 Door Status Indication

CANoe
Door status indication shows doors closed when doors are opened in rig.

16.20 Trunk Status Indication

CANoe
Not functioning
16.21 Hood Status Indication

CANoe
Opening the hood on the rig is not indicated on panel.

16.21.1 Siren-/Horn Indication

CANoe
Siren and horn is indicating theft deterrent.

Rig
Not functioning

16.22 Trigging Theft Deterrent

Driver Door
Trigs on rig activation

Passenger Door
Trigs on panel activation

Rear Right Door
Trigs on rig activation

Rear Left Door
Trigs on panel activation

Hood
Trigs on rig activation

Trunk
Trigs on rig activation

Glass Break Detection
Trigs on panel activation

Ultra Sonic Detection
Trigs on panel activation

Tilt Detection
Trigs on panel activation
17 Reflections

Alarming indication differed inconsequentially during the test.

During the test the activations of theft deterrent have differed. Sometimes rig trunk lock has trigged the alarm, sometimes the panel. The reason for this could not be determined.

Also the trig of sensors varied during the testing.

Occasionally the system trigged the alarm by some reason that could not be determined. IT was difficult to get rid of this fault. Sometimes it was enough by reset the system, but often it was necessarily to change node and back again.

Some adjustments are necessary to be able to use this method for testing single nodes.