

CANoe .CANaero

Product Information

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This document presents the CANoe .CANaero application areas of analysis, stimulation/simulation, testing and their individual functions. The document also contains a brief overview of programming in CANoe, supplemental programs as well as hardware and software interfaces.

Product information and **technical data** on CANoe in general are available in a separate document.

1 Introduction

Over the years, a number of bus systems have become established in aerospace engineering. CAN is playing an increasingly important role here. CANoe .CANaero is a versatile tool for developing, testing and analyzing entire avionics networks as well as individual electronic units. Network designers, development and test engineers at aircraft manufacturers, system suppliers and component producers will all benefit from its many different functions and configuration options.

1.1 Overview of Advantages

- > Reliable testing of the bus communications between electronic units – from simple interactive testing in design or implementation to systematic automated testing
- > Automatically generated test reports
- > Easy observation of data traffic and comprehensive network analysis
- > Time-synchronous analysis of multiple buses and optional support of Ethernet enable gateway developments and tests
- > Support of the protocols ARINC 825 and ARINC 826
- > Open interfaces and database concept offer optimal support for proprietary protocols as well

1.2 Application Areas

CANoe .CANaero covers all use areas from simple network analysis to systematic testing of electronic units. The multibus approach lets you simultaneously operate multiple channels, different bus systems such as CAN, Ethernet and FlexRay as well as different protocols.



Figure 1: Display of data in the Trace, data and statistics windows. Interactive generation of messages.

1.3 Further Information

> [Vector Download-Center](#)

Various documents related to CANoe are available on the Internet. In the Demo version, for example, you get sample configurations for the various use areas and detailed online Help texts, in which all CANoe functions are described. In addition, you benefit from our valuable know-how in the form of technical articles, product videos and application notes.

> [CANoe Feature Matrix](#)

More information on variants, channels and bus system support is presented in the feature matrix.

2 Functions

Basic functions offer an abundance of capabilities such as:

- > Simulation of complete systems and remaining bus simulation via modeling
- > Tracing of the bus data traffic
- > Test entire networks and/or individual electronic units
- > User programmable with integrated C-like CAPL programming language to support simulation, analysis and testing
- > Interactive sending of messages
- > Statistics on nodes, messages, bus load and faults
- > Logging of messages for later replay or offline evaluation with versatile triggering options
- > Generation of bus disturbances
- > Creation of user-defined interfaces for controlling the simulation and tests or for displaying analysis data
- > Control of digital and analog I/O modules and measurement hardware lets you process real signal values in simulations and test environments.
- > Open software interfaces such as Microsoft COM and .Net enable integration in existing system environments.

3 Database Support

In a project database you can assign such attributes as project-specific names, conversion formulas and physical units to messages and their data segments. The database is set up and maintained with the CANdb++ data management program that is supplied with the product.

For systems in which ICD files are provided for the communication description, the supplied converter can be used to convert the description to the internal database format.

Building upon this database, it is possible to represent messages and their data contents on the system level, service level and message level. Examples are: Cabin Pressure Control, Water Waste, Body Pitch Angle, Boiler Water Temperature and much more. This is also how you parameterize sending of messages and their data contents.

4 Communication Monitoring

In the Trace window, the CAN message traffic is displayed, and the protocol information it contains is simultaneously interpreted. You not only see which service is currently being executed, you can also view the relevant parameters at a glance. To simplify the analysis, the data can be shown in different font and background colors. This gives you a quick overview of the chronological flow of individual protocol sequences. CANoe .CANaero supports the protocols ARINC 825 and ARINC 826.

The columns of the Trace window are user configurable for proprietary protocols. CAN identifiers can be subdivided into segments and displayed in separate Trace window columns. In addition, you can define a value table for each identifier segment, which gives you a text interpretation of the different segments during the measurement. This greatly simplifies the interpretation of proprietary protocols.

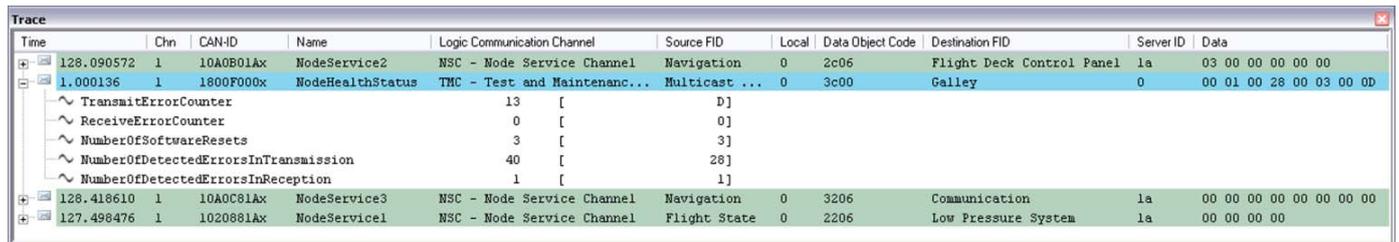


Figure 2: Display of ARINC 825-specific data in the Trace window. The different colors represent different ARINC services in the Trace window, and this greatly simplifies bus analysis. A font color and background color may be defined for each category so that messages can be recognized easier and quicker.

5 Testing Electronic Units and Networks

One of the primary use cases of CANoe is the testing of electronic units and networks. Examples include: Verification of individual development steps, checking of prototypes, and performance of regression and conformity tests.

The Test Feature Set with its extensive functions supports you in implementing your testing tasks – simply and flexibly:

- > Sequential test flows are implemented with CANoe in XML, CAPL or .NET test modules that are subdivided into test groups and test cases. The individual test modules can be executed at any time during a measurement. In XML modules, tests are assembled from predefined test patterns and are easy to parameterize by input and output vectors. The different description formats may also be combined, depending on requirements. You can monitor system states in parallel to test execution, e.g. or conformance of individual messages to cycle times. These constraints are automatically incorporated into the test evaluation.
- > The Test Service Library contains a collection of prepared test functions that simplify the process of setting up tests. They are used in the test modules and are parameterized from the database. This lets you monitor such parameters as the cycle times of messages, the reaction time of an electronic unit or the validity of signal values. To evaluate the quality of tested electronic units, various statistical values are output from tests, including the number of deviations reported over the testing period.
- > When a test module is executed, an extensive test report is generated. For example, the names of the test cases already executed and individual test results are logged. The test record can be supplemented with user-defined information or with automated screenshots of the various analysis windows. CANoe writes the results to a flexible XML file that can be further processed. An XSLT style sheet is used to customize the output format of the test report.
- > Direct driving of I/O hardware in CANoe makes it possible to use digital and analog electronic unit interfaces in addition to the bus communication. Besides offering standard I/O components, the Vector VT System also takes a modular hardware approach that simplifies the setup of test benches tremendously and enables comprehensive testing of electronic units.

- > Special references in the XML test modules link test cases with the requirements. With this it is for example possible to insert hyperlinks in the test report to navigate directly to the elements in Telogic DOORS modules.

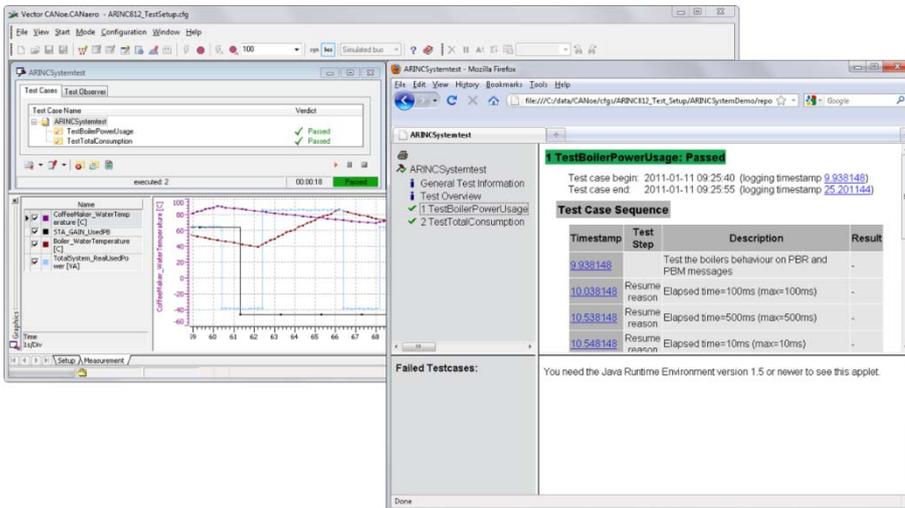
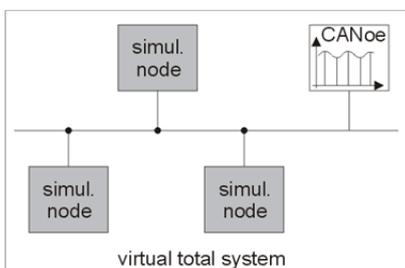


Figure 3: Test sequence example with associated test record in HTML

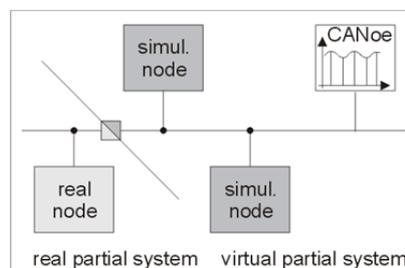
6 Simulation and Remaining Bus Simulation

In the development of distributed communication systems with CANoe, network node models are created based on database information. The communication behavior of these models can be fully simulated and analyzed. Over the course of the subsequent development process, you can replace individual node models by real electronic units within this simulation. These remaining bus and environment simulations give the supplier a development and test environment for the total system as well as for individual electronic units and modules.

Phase 1



Phase 2



Phase 3

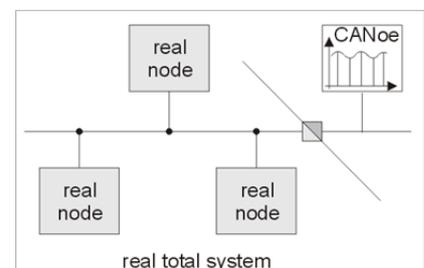


Figure 4: The development process with CANoe from network simulation to the real total system

7 Hardware Interfaces

CANoe .CANaero supports all hardware interfaces available at Vector. Thanks to the large selection of different PC interfaces (PCMCIA, ExpressCard, USB, PCI, PCI-Express, PXI) and of bus transceivers, optimal bus access is possible for any use case.

8 Supported Protocols

8.1 ARINC 825

The "General Standardization of Controller Area Network Bus Protocol for Airborne Use" defines fundamental communication concepts for the use of CAN. It supports the IMA approach and offers addressing mechanisms that extend beyond system boundaries such as AFDX.

8.2 Proprietary protocols

Because of its database approach and open interfaces, CANoe .CANaero can be extended to handle proprietary protocols.

9 Training

As part of our training program, we offer various classes and workshops on CANoe in our classrooms at Vector and on-site at our customers.

You will find more information on individual training courses and a schedule online at: www.vector-academy.com



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